CHAPTER 9
SURFACE WATER QUALITY

Maintaining water quality in California's water bodies is important to ensure safe drinking water and to protect recreational, environmental, industrial, and agricultural beneficial uses. This chapter describes the existing quality of the water resources within the project study area, and discusses the potential water quality effects that could be expected to occur in response to implementing one of the alternatives evaluated in this EIR/EIS.

9.1 ENVIRONMENTAL SETTING/AFFECTED ENVIRONMENT

Because of the coordinated operations of water projects in California, where management decisions or alterations in one basin may directly impact the operation of projects in another basin, the alternatives considered in this EIR/EIS have the potential to affect water quality parameters in several watersheds. The area of analysis for surface water quality in this evaluation includes the Yuba, Feather and Sacramento River basins, and the Delta. Each of the water bodies in the proposed study area has multiple beneficial uses, and exists within an established regulatory framework that mandates specific water quality requirements and related concerns. Hence, analysis of the changes in water quality parameters that would result from implementation of the Yuba Accord Alternative or the Modified Flow Alternative require consideration in relation to of the water quality standards and beneficial uses specified in the various WQCPs (see Section 9.1.4) currently in effect for the relevant regions. In addition to delineation of the areas of analysis and a description of the regulatory environments for these areas, the following discussion also presents a summary of existing water quality information related to the affected environment.

9.1.1 YUBA REGION

For the purposes of this water quality evaluation, the Yuba Region is defined as: (1) New Bullards Bar Reservoir; (2) the lower Yuba River from Englebright Dam to its confluence with the Feather River; (3) the riparian corridor along the North Yuba River downstream of New Bullards Bar Dam; (4) the YCWA Member Unit water service areas; (5) the local groundwater basins; and (6) lands overlying the groundwater basins.

The Yuba River Basin, including the South, North and Middle Yuba rivers, encompasses an area of about 1,339 square miles and spans several counties (YCWA 2005b). Land uses are primarily agricultural and urban (see Chapter 16). In addition, the forestland in the Yuba River Basin historically experienced a notable amount of placer and hard rock gold mining. The basin is 85 percent forested with the remaining land divided between rangeland (10 percent), agriculture (1 percent), urban and residential (<1 percent) and other land features, such as water bodies, wetlands, snowfields, tundra, and transitional areas (Sacramento River Watershed Program 2001).

Within the Yuba Region, drinking water is primarily provided from groundwater, while surface water is the primary source of water for irrigation. However, an exception to this trend exists in the Wheatland area, where groundwater is exclusively utilized for both drinking and irrigation water (YCWA 2005b). Although unrelated to the Proposed Yuba Accord, YCWA is currently in the process of creating the infrastructure to provide surface water to 7,750 acres of land within the WWD service area.

The Proposed Project/Action and alternatives could potentially influence the water quality parameters of area water bodies, and water subsequently distributed for agricultural use. Furthermore, surface water quality effects may eventually have municipal and industrial supply effects in the Wheatland Area.

The following discussion provides further details on the condition of Yuba Region water bodies at several locations. In addition, for each water body, existing available information related to past water quality evaluations is presented.

9.1.1.1 NEW BULLARDS BAR RESERVOIR

New Bullards Bar Reservoir is located in Yuba County on the North Yuba River approximately 21 miles north of Nevada City. While water quality data specific to the reservoir are unavailable, a range of water quality parameters collected on the North Yuba River just upstream of New Bullards Bar Reservoir are presented in **Table 9-1.** Total organic carbon (TOC) and nitrogen were collected during an eight-month period in 2001, with a total of seven samples being collected for each parameter. For each remaining parameter, a total of seven samples were collected over a 12-month period. Water quality data for other water quality parameters, like metals and organophosphate pesticides, are currently not available for New Bullards Bar Reservoir.

Table 9-1. Water Quality Parameters Sampled on the North Yuba River Upstream of New Bullards Bar Reservoir

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	7.0	8.1	7.2
Turbidity (mg/l)	0	44.7	11.5
Dissolved Oxygen (mg/l)	8.3	12.3	9.9
Total Organic Carbon (mg/l)	0.59	2.6	1.3
Nitrogen (nitrite-nitrate) (mg/l)	0.025	0.050	0.04
Electrical Conductivity (µS/cm)	20	30	23.8
Sources: (SYRCL 2002; USGS 2001) mg/l = milligrams per liter µS/cm = microsiemen per centimeter			

9.1.1.2 LOWER YUBA RIVER

The lower Yuba River extends from Englebright Dam downstream to the confluence with the Feather River. Surface water quality in this reach has been previously monitored near Marysville (directly upstream of the Yuba River's confluence with the Feather River) by the Sacramento River Watershed Program (Sacramento River Watershed Program 2001). Twenty-seven samples were collected over a three-year period between 1996 and 1998. The minimum, maximum, and average parameters for pH, turbidity, dissolved oxygen, TOC, nitrogen, and electrical conductivity (EC) are presented in **Table 9-2**.

Table 9-2. Water Quality Parameters Sampled on the Yuba River Near Marysville

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	7	7.8	7.5
Turbidity (mg/l)	1	153	29.9
Dissolved Oxygen (mg/l)	8	12.4	11.4
Total Organic Carbon (mg/l)	0.7	2.4	1.1
Nitrogen (nitrite-nitrate) (mg/l)	0.05	0.137	0.07
Electrical Conductivity (µS/cm)	44	105	72.8
Source: (USGS 2002)			

In addition to the above constituents, SYRCL also has developed a citizen's monitoring program, funded since 2000 by a grant sponsored by the RWQCB, to collect surface water samples and monitor water quality conditions in the watershed. This effort has identified arsenic, bacteria and mercury as parameters of concern within the Yuba River Basin (SYRCL Website 2005). The temperature of water distributed for irrigation of agricultural lands, particularly related to rice cultivation, has also been identified as a potential water quality concern in the Yuba Region. Additional detail related to each of these issues is provided below.

ARSENIC

Arsenic is ubiquitous in nature and is commonly found in drinking water sources in California. Because of rock-water interactions, concentrations of arsenic in groundwater are likely higher than those found in surface waters, and therefore, the utilization of groundwater by municipal water systems may cause higher arsenic levels than would occur in systems using only surface water. Also, if groundwater levels are depleted, then additional releases of arsenic from underground rock formations may occur (EPA Website 2007). Additionally, as part of the gold extraction process associated with past mining activities, arsenic can be leached from the natural rock and its presence in the environment is strongly correlated with the presence of mercury (Slotton *et al.* 1997).

Arsenic is often detected at levels above the maximum contaminant levels (MCL)[1] established by the EPA. A new federal MCL for arsenic of 10 μg/L became effective in January 2006, and provides a much greater level of protection than the previous standard of 50 μg/L. Recent nationwide monitoring results indicate that eight times as many groundwater sources exceed the new standard then exceeded the previous standard. The existing agricultural water quality goal for arsenic is 100 parts per billion (ppb), and the protective criterion for freshwater aquatic life is 150 ppb (4-day average) (RWQCB 2000).

BACTERIA

In 2001, water quality sampling in the South Yuba River detected elevated levels of *Enterococcus sp.*, a fecal coliform bacteria produced from either human or animal sources. Because enterococci bacteria are known to be responsible for a number of human illnesses, including urinary tract and intestinal infections, the positive identification of this bacterium necessitated the issuance of a health advisory by the Nevada County Departments of Environmental Health and Community Health to warn recreational uses of the potential hazard (SYRCL Website 2005). Since 2001, the Yuba River Citizen Monitoring Project has extended monitoring efforts and continues to investigate the extent and causes of enterococci contamination in the Yuba River. Working closely with the California Department of Health Services (CDHS) and the SWRCB, SYRCL found that algae present in river water samples could generate false positive signals in the testing assays, leading to warnings by the state to utilize a back-up method to test for enterococci (CALFED Bay-Delta Program Website 2007).

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[1] MCLs are defined as the highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards that are set as close to the level of a contaminant in drinking water below which there is no known or expected risk to health as feasible using the best available treatment technology and taking cost into consideration (EPA Website 2005).

MERCURY

As previously noted, forested lands in the Yuba River Basin have experienced notable amounts of mining. Historically, mercury was used in the basin to recover gold from both placer deposits and ore-bearing minerals. Because residual mercury from those operations has been detected in invertebrate and fish communities in the vicinity and downstream of areas where gold mining operations occurred (May *et al.* 2000; Slotton *et al.* 1997), a fish ingestion advisory was issued in 2003 and remains in effect for this area (Section 9.2.2).

Health advisories and consumption guidelines issued by the California Office of Environmental Health Hazard Assessment (OEHHA) for Nevada, Placer and Yuba counties in 2003 recommended limits on the consumption of bass and several other species in some reservoirs and streams in the watersheds of the Bear and Yuba rivers due to elevated levels of methyl mercury, the form of mercury most commonly found in fish (OEHHA Website 2007). The primary source of methyl mercury is thought to be surface water run-off and sediment originating from abandoned mines located upstream.

The CDHS lists 2 μg/L as the primary MCL for inorganic mercury. To date, there are no agricultural water quality goals for mercury identified, and the protective criterion for freshwater aquatic life is 0.77 ppb (4-day average) (RWQCB 2000). In addition, the 2000 California Toxics Rule specifies that consumption of water and fish should not exceed a 30-day average daily dose of 0.05 ppb (RWQCB 2000).

According to Slotton *et al.* (1997), reservoirs constructed immediately downstream of gold mining operations act as "sinks" for mercury, trapping the metal in the sediments in the bottoms of the reservoirs. Although Englebright Dam and Reservoir were constructed several decades ago, mercury transported downstream to the lower Yuba River before reservoir construction likely is still present in and perhaps is leaching from streambed and floodplain sediments. Therefore, the effects of these past activities also may be affecting water quality in the downstream reaches of the lower Yuba River and other receiving waters. The water quality data provided in **Table 9-3**, collected near Marysville, captures influences of most upstream land uses and geomorphic conditions. Collected for the Oroville Dam's relicensing effort, these data provide an indication as to the quality of water entering the Feather River from the lower Yuba River.

Table 9-3. Chemicals Detected in Samples Collected on the Yuba River at the Confluence with the Feather River

Yuba River at Mouth of Feather River			
	# of Samples	**Minimum**	**Maximum**
pH (standard units)	30	7.1	7.4
Turbidity (NTU)	30	0.5	17.2
Dissolved Oxygen (ppm)	30	8.4	14.2
Total Organic Carbon (mg/l)	29	0.8	3.6
Nitrate + Nitrite (mg/l)	30	<0.01	0.2
Total Phosphorus (mg/l)	30	<0.01	0.08
Mercury (ng/L) [a]	27	1.194	46.66
Conductivity (μS/cm)	29	76	128

Source: (DWR Website 2005)
[a] Total of 27 samples collected by USGS from 1996 to 1998 (USGS Website 2007).

IRRIGATION WATER TEMPERATURE RELATED TO RICE CULTIVATION

Rice is cultivated in the majority of the Member Unit areas under agricultural production in Yuba County. Rice production typically occurs on clays or other poorly drained soils with impervious layers. These soil types are fairly impermeable to water, which increases their water use efficiency for rice production. Rice is an aquatic crop requiring almost continuous flooding until the time of harvest. Fields intended for rice crop seeding typically are initially flooded during April or May, which accounts for the peak in agricultural water diversion volumes during this time period.

Rice farmers require warmer water during the spring and summer for germination and growth of rice (i.e., 65°F from approximately April through mid-May, and 59°F during the remainder of the growing season) (DWR 2001a). Generally, water temperatures for rice production are reported to be suitable above 60°F to 65°F (Mutters *et al.* 2003b). Research indicates that an entire crop may be lost as a result of exposure during the early growing season to as little as four days (100 hours) with water temperatures below 55°F, and about 60 percent yield reduction may occur as a result of exposure to as little as eight days (200 hours) of water temperatures below 60°F (Mutters *et al.* 2003b).

Low water temperatures early in the growing season can cause delayed or failed germination, reduced growth rates, reduced or delayed tillering, panicle sterility, or seed head blanking (Williams and Wenning 2003). Yield reduction associated with cold water has been reported to be most pronounced when cold water exposure occurs early during the growing season (six to seven weeks after planting) (Mutters *et al.* 2003a; Mutters *et al.* 2003b). However, reproduction, which occurs slightly later reportedly also is affected by reduced water temperatures (Mutters *et al*. 2003a).

Effects of cold water on rice yield tend to be localized near the field irrigation inlet, although effects have been observed in adjacent checks where cold water has seeped though the dividing levee (Mutters *et al*. 2003a). Rice production within checks tends to be affected by cold water temperatures in a predictable pattern of distribution of varying severity of effect. Water applied to rice paddies is diverted from the main diversion canals via turnouts. The temperature of water entering the paddy tends to be the coldest water temperature in the field, such that losses to yield are most often observed in association with the turnouts, with decreasing expression of cold water-related effects in proportion to the distance from the turnout.

SUMMARY

Overall, the water quality of the lower Yuba River is good, and has improved in recent decades. The improved conditions have been attributed to controls on hydraulic and dredge mining operations, and the establishment of minimum instream flows (Beak Consultants 1989). Dissolved oxygen concentrations, total dissolved solids (TDS), pH, hardness, alkalinity, and turbidity are well within acceptable or preferred ranges for salmonids and other key freshwater biota (Reclamation *et al.* 2003). Changes in pesticide regulations have also improved local water quality. The surface water monitoring performed by the Sacramento River Watershed Program over the past decade generally indicates that water quality supports the beneficial uses (e.g., irrigation, fisheries habitat) designated for the water bodies in the Yuba River Basin (Sacramento River Watershed Program 2005). To date, no total maximum daily loads (TMDL) have been developed or are proposed for the Yuba River (see Section 9.2). However, there are plans to develop a TMDL for pH in Deer Creek, a tributary to the Yuba River (SWRCB 2003).

9.1.2 CVP/SWP UPSTREAM OF THE DELTA REGION

The CVP/SWP Upstream of the Delta Region includes the reservoirs, rivers and components of the CVP and SWP that may be affected by integrated operation of the CVP/SWP system under the alternatives considered for the Proposed Yuba Accord. Facilities included in this region include: (1) Shasta Reservoir (CVP); (2) the Sacramento River downstream of Shasta Dam to the Delta; (3) Oroville Reservoir (SWP); and (4) the Feather River downstream of the Oroville Facilities to the confluence with the Sacramento River.

9.1.2.1 SACRAMENTO RIVER BASIN

The Sacramento River Basin covers nearly 70,000 square kilometers (km^2) in the north-central part of California (USGS Website 2007). Water originating from the Sacramento River drainages represents a significant component of the total CVP supply, which provides high quality water to meet downstream urban and agricultural demands. The Sacramento River watershed is predominantly forestland (approximately 65 percent), with the balance of the land uses being rangeland (approximately 20 percent), agriculture (approximately 10 percent), urban/ residential (<2 percent), and wildlife habitat/other.

The Sacramento River Watershed Program has identified mercury, organophosphate pesticides, toxicity, and drinking water parameters as chemicals of concern in the Sacramento River watershed, which includes the Sacramento and Feather rivers, and the Delta (Sacramento River Watershed Program 2001).

SACRAMENTO RIVER

The Sacramento River is the largest river in California, providing water for municipal, agricultural, recreation, and environmental purposes throughout northern and southern California (Sacramento River Watershed Program 2001). General water quality data reported for several locations along the Sacramento River are presented in the following sections.

UPPER SACRAMENTO RIVER

The upper Sacramento River sampling site is above Bend Bridge near Red Bluff and is located 83.7 km downstream of Shasta Dam. Stream flow is greatly influenced by managed releases from Shasta Reservoir and, during the rainy season, by storm water runoff. The stream channel is in a natural state, with no artificial levees. The drainage basin area at this site is 23,569 km^2 and includes parts or all of the Great Basin, Middle Cascade Mountains, Klamath Mountains, Coast Ranges, and Sacramento Valley physiographic provinces. Land cover in the area is mainly forestland; cropland, pastures and rangeland cover most of the remaining land area.

Based on a comprehensive review of hydrologic model output the upper Sacramento River including Shasta Reservoir downstream to the Feather River confluence is not included in the detailed evaluation of potential impacts related to the implementation of the Proposed Project/Action and alternatives. The hydrologic model output indicates that changes in the hydrologic pattern of water bodies upstream of the Feather River confluence resulting from the implementation of the Proposed Project/Action and alternatives is not likely to occur and therefore further discussion of potential impacts is not warranted. For a full discussion of hydrologic modeling results see Chapter 4.

Sacramento River at Freeport

The Sacramento River sampling site at Freeport is the farthest downstream USGS monitoring site on the Sacramento River. Therefore, water quality samples at this site reflect the combined effects of land uses, land covers and physiographic provinces of the entire watershed. Forestland is the largest land use cover upstream in the watershed (USGS 2002). A total of 31 samples were collected over a three-year period (1996-1998), and data for the general water quality parameters is presented in **Table 9-4**.

Table 9-4. Water Quality Parameters Sampled on the Sacramento River at Freeport

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	7	8.1	7.7
Turbidity (mg/l)	12	368	53.9
Dissolved Oxygen (mg/l)	6.5	12.2	9.7
Total Organic Carbon (mg/l)	0.3	3.7	1.7
Nitrogen (nitrite + nitrate) (mg/l)	0.058	0.257	0.13
Total Phosphorus (mg/l)	0.010	0.04	0.017
Electrical Conductivity (µS/cm)	51	166	124.3
Source: (USGS Website 2007)			

9.1.2.2 FEATHER RIVER BASIN

The Feather River is the largest tributary to the Sacramento River. The Feather River watershed is located in California's northern Sierra Nevada and encompasses a broad variety of terrain, climate, historic use, and flora and fauna (University of Michigan Website 2006). The Plumas National Forest manages over 80 percent of the upper watershed, while the alluvial valleys (approximately 11 percent) are predominantly privately owned and used for livestock grazing. The rest of the land is used for other agricultural purposes, urban development, and wildlife habitat.

Water originating from Feather River drainages represents a significant component of the SWP, which provides water to meet downstream urban and agricultural demands. In addition, a series of hydroelectric dams, powerhouses and reservoirs produce over 4,000 MW of power, while the watershed produces significant forest and agricultural outputs.

Flow in the lower Feather River is controlled mainly by releases from Oroville Reservoir, the second largest reservoir within the Sacramento River Basin, and by flow from the Yuba and Bear rivers. As with many Sierra Nevada foothill streams and rivers, the Feather River basin has historically been influenced by large-scale gold mining operations. To a lesser degree, gold mining operations still are ongoing within the western slope watersheds.

The Sacramento River Watershed Program identified mercury, organophosphate pesticides,, and other chemical parameters affecting drinking water quality as primary concerns for the Sacramento River watershed, which includes the Sacramento and Feather rivers, and Delta (Sacramento River Watershed Program 2005). Both the Yuba River and the Bear River basins have been affected by past gold mining activities and as a result, contribute mercury to the lower Feather and Sacramento rivers (May *et al.* 2000). The Feather and Yuba rivers are significant sources of mercury loads, but water column concentrations of total mercury and methyl mercury were not elevated compared to the mainstem Sacramento River during 2000 through 2004 (Sacramento River Watershed Program 2005), suggesting that other sources of mercury are responsible for the mercury observed in the Sacramento River.

OROVILLE RESERVOIR

Oroville Reservoir is primarily used for water supply, power generation, flood control, fish and wildlife enhancement, and recreational purposes (DWR 2001a). Water quality in Oroville Reservoir is influenced by tributary streams, of which the Middle, North, and South forks of the Feather River contribute the majority of inflow. The minimum and maximum pH, turbidity, dissolved oxygen, TOC, nitrogen, phosphorus, and EC in Oroville Reservoir collected bimonthly from January 1992 to May 1997 near Oroville Dam are presented in **Table 9-5.**

Table 9-5. Water Quality Parameters Sampled at Oroville Reservoir

Water Quality Parameter	Minimum	Maximum
pH (standard units)	6.8	7.4
Turbidity (mg/l)	0.58	25
Dissolved Oxygen (mg/l)	7.8	12
Total Organic Carbon (mg/l)	N/A	N/A
Nitrogen (nitrite-nitrate) (mg/l)	0.01	0.13
Total Phosphorus (mg/l)	0.01	0.57
Electrical Conductivity (µS/cm)	31	85
Source: (DWR 2001a) N/A – not available		

LOWER FEATHER RIVER

The minimum, maximum, and average values for a variety of water quality parameters in the lower Feather River are presented in **Table 9-6**. The data represents 27 samples collected near Nicolaus, California over a three-year period (1996-1998).

Table 9-6. Water Quality Parameters Sampled on the Feather River near Nicolaus

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	7.4	8.4	7.7
Turbidity (mg/l)	8	123	36.5
Dissolved Oxygen (mg/l)	9	15.7	10.1
Total Organic Carbon (mg/l)	1.2	3.2	1.7
Nitrogen (nitrite-nitrate) (mg/l)	0.05	1.63	0.15
Total Phosphorus (mg/l)	0.010	0.02	0.013
Electrical Conductivity (µS/cm)	56	122	84.7
Source: (USGS 2002)			

In addition to the data provided in Table 9-6, additional water quality information has been collected more recently as part of the FERC relicensing process for the Oroville facilities (**Table 9-7**). With one sampling location found upstream of the Yuba River confluence and one located downstream of the Yuba River confluence, these data provide a rudimentary indication of the influence that the Yuba River inflow may have on Feather River water quality.

FEATHER RIVER TRIBUTARIES

Two Feather River tributaries are included in the discussion of the regional study area: (1) the Bear River; and (2) Dry Creek. Groundwater pumping activities during drier year conditions associated with the Proposed Yuba Accord could affect the hydraulic interactions between the groundwater basin and the overlying surface water system, which could reduce instream flow in these tributaries. A decrease in river flows could increase the concentrations of contaminants within these rivers, thereby affecting the water quality conditions.

Table 9-7. Water Quality Parameters in Samples Collected on the Feather River Upstream and Downstream (Shanghai Bench) of the Yuba River

	Feather River Upstream from Yuba River			Feather River at Shanghai Bench		
	# of Samples	Min	Max	# of Samples	Min	Max
pH (standard units)	30	7.1	7.5	29	7.2	7.5
Turbidity (NTU)	30	1.2	63.4	30	1.6	70.1
Dissolved Oxygen (ppm)	30	8.6	13.6	30	8.9	13.2
Total Organic Carbon (mg/l)	29	1.4	7.5	29	1.4	7.5
Nitrate + Nitrite (mg/l)	30	0.01	1.14	29	<0.01	0.28
Total Phosphorus (mg/l)	30	0.02	0.14	30	0.02	0.19
Mercury (mg/l)	30	0.001	0.019	30	0.001	0.018
Methyl Mercury (mg/l)	29	<0.000	0.000	29	0.000	0.000
Conductivity (µS/cm)	29	72	118	29	76	112
Source: (DWR Website 2005)						

Dry Creek

Dry Creek is located within the Sacramento Valley Groundwater Basin in southern Yuba County, extending from the eastern groundwater boundary to the confluence with the Bear River. Dry Creek is a perennial tributary that drains from the western slope of the Sierra Foothills. Information related to water quality for Dry Creek is limited, due in part to the fact that no hydropower projects exist on Dry Creek. The USGS Gage on Dry Creek at Wheatland provides instream flow information but no water quality data.

Bear River

Within the Sacramento Valley Groundwater Basin, the upper portion of Bear River serves as the boundary line between Yuba and Placer counties, and extends from the eastern groundwater boundary to its confluence with the Feather River. Flows within Bear River are continuous and dependent upon releases from Camp Far West Diversion Dam. The minimum, maximum, and average levels of general water quality parameters sampled from the Bear River are presented in **Table 9-8**. All of the samples were collected on the Bear River near Wheatland in Yuba County over a three-year period (1999-2002). A total of 34 samples were collected for pH, 14 samples were collected for turbidity, 30 samples were collected for dissolved oxygen, 37 samples were collected for phosphorous, and 35 samples were collected for TOC and EC.

Table 9-8. Water Quality Parameters Sampled on the Bear River near Wheatland

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	7	8.1	7.7
Turbidity (mg/l)	0	106	17.9
Dissolved Oxygen (mg/l)	7.3	13.3	9.8
Total Organic Carbon (mg/l)	1.2	3	2
Total Phosphorus (mg/l)	.002	.019	.005
Electrical Conductivity (µS/cm)	63	160	107.7
Source: (USGS Website 2004) N/A – not available			

9.1.2.3 *WATER QUALITY CONSIDERATIONS RELATED TO GROUNDWATER AND SURFACE WATER INTERACTIONS*

Although Chapter 6 contains a more detailed discussion of groundwater issues, groundwater quality within the project study area also is briefly discussed below, because of the potential for water quality impacts related to changes in hydraulic continuity and groundwater/surface water interactions, which could occur as a result of implementing the Proposed Project/Action or an alternative. Additionally, changed conditions associated with groundwater use during drier years, when a higher percentage of groundwater may be used for irrigation, are considered for this resource, due to the possible affects on crop production and the quality of agricultural runoff under both the Proposed Project/Action and the Modified Flow alternatives.

Soils of the Central Valley consist of a thick accumulation of sediments [fine grained soil], with the bulk of the deposition having occurred in a marine environment [soil is high in salts] (Hull 1984). Groundwater quality is affected by water-rock interactions and shows a great diversity in chemical composition throughout the Central Valley (Hull 1984). In general, groundwater in the relatively drier western portion of the Central Valley has higher mineral and salt content than groundwater in the eastern part of the valley, where years of higher rainfall have leached salts from the soil. In addition, groundwater along the east and southeast margins of the valley, extending westward to near the Feather and Sacramento Rivers, has a low average dissolved solids (low TDS) content reflecting recharge from the high quality Sierra Nevada surface water/snowmelt (Hull 1984). In the east-central part of the valley, from Oroville to Marysville, the Feather, Yuba, and Bear rivers recharge the groundwater near the valley margin (Hull 1984). Concentrations of calcium, magnesium, bicarbonate, boron and sulfate are low in the eastern part of the Central Valley, while silica is high, reflecting the volcanic material present in the sediments.

The Sacramento Valley Groundwater Basin extends from the southern edge of the Redding Groundwater Basin to the San Joaquin Valley and includes portions of Tehama, Glenn, Butte, Yuba, Sutter, Colusa, Placer, Solano, Sacramento, and Yolo counties. Groundwater provides about 22 percent of the water supply and is used extensively as a source of drinking and irrigation water, particularly in areas removed from surface water supplies (USGS Website 2005). The Sacramento Valley Groundwater Basin can be considered a single-aquifer system, and has a storage capacity of about 114 MAF, at depths ranging from 20 to 600 feet below land surface. Groundwater is recharged by deep percolation of applied water and rainfall, infiltration from streambeds, and lateral inflow along the basin boundaries. Groundwater in the Sacramento Valley Groundwater Basin flows through a broad alluvial aquifer and, therefore, is not confined to any well-defined subsurface stream channels.

The primary surface water feature in the Sacramento Valley Groundwater Basin is the Sacramento River, which has several major tributaries (e.g., Feather and Yuba rivers) that drain the upstream watersheds in the Sierra Nevada. Surface water and groundwater interact on a regional basis and, as such, gains and losses to groundwater vary significantly geographically and temporally. Natural groundwater quality is influenced by stream flow and recharge from the surrounding Coast Ranges and Sierra Nevada. Runoff from the Sierra Nevada is generally of higher quality than runoff from the Coast Ranges because of the presence of marine sediments in the Coast Range. Groundwater quality in the Sacramento Valley Groundwater Basin is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. However, there are some localized groundwater quality problems.

YUBA REGION

DWR maintains data from 27 water quality wells in the South Yuba Subbasin (DWR 2003a). Data collected from these wells indicate a TDS range of 141 to 686 milligrams per liter (mg/l) and a median of 224 mg/l. In general, water with TDS concentrations below 1500 mg/l is considered good for irrigation (RWQCB 2000). The primary water chemistry in the area indicates calcium magnesium bicarbonate or magnesium calcium bicarbonate groundwater. Some magnesium bicarbonate can be found in the northwest portion of the basin.

Groundwater in the Yuba Basin is generally of good quality for both drinking water and irrigation (YCWA 2005b). However, at least two of the wells near Wheatland have been capped due to poor water quality and crop damage from poor groundwater quality has been observed at one ranch (YCWA 2005b).

Groundwater–rock interactions can increase metals concentrations in groundwater above those in the surface water. DWR has also detected inorganics, including metals, above secondary drinking water MCLs in the groundwater (**Table 9-9**) (DWR 2003a). The additional metals present in groundwater not captured in agricultural soils or crops may be discharged to local surface water bodies through runoff.

Table 9-9. Groundwater Quality in Public Supply Wells - South Yuba Subbasin (1994-2000)

Constituent Group	Number of Wells Sampled	Number of Wells with a Concentration Above an MCL
Inorganics—Primary	38	2
Inorganics—Secondary	38	32
Radiological	31	0
Nitrates	43	0
Pesticides	33	0
Volatile Organic Carbon and Semi-volatile Organic Carbon Compounds	33	1
Source: (DWR 2003a)		

Occurrences of both groundwater contamination and increases in TDS have been documented in the Basin (YCWA 2005b), but are localized. Farmland has the potential to contaminate the groundwater with nitrates and pesticides. Beale Air Force Base has documented impacts to groundwater from a solvent, trichloroethylene. Fuel storage tanks throughout the Basin have or have potentially impacted groundwater (YCWA 2005b).

Salinity

Salinity is a measure of the mass fraction of salts, measured in ppt. TDS is a measure of the concentration of salt, as measured in mg/l (DWR 2001b). At present, saline intrusion has not been identified as a problem for Yuba Subbasin groundwater (YCWA 2005b). However, there is a potential for agricultural practices (for example, repeated use of the same water for irrigation) to contribute to salinity. YCWA is monitoring this condition (YCWA 2005b).

9.1.3 DELTA REGION

The Delta Region includes waterways in the Delta. The Delta forms the lowest part of the Central Valley, bordering and lying between the Sacramento and San Joaquin rivers, and extending from the confluence of these rivers inland as far as Sacramento and Stockton. The Delta is the source of drinking water for more than 23 million Californians in the San Francisco Bay area, Central Valley, and Southern California. The Delta is also an important agricultural area, with more than 75 percent of the Delta region's total agricultural production in the form of corn, grain, hay, and pasture. Although much of the Delta is used for agriculture, Delta lands also provide habitat for wildlife. Many agricultural fields are flooded in the winter, providing foraging and roosting sites for migratory waterfowl. In addition to lands that are used seasonally, CDFG manages thousands of acres specifically for wildlife including Lower

Sherman Island and White Slough Wildlife Areas, Woodbridge Ecological Reserve, and Palm Tract Conservation Easement (SWRCB 1997).

Recognized water quality issues in the Delta include the following:

- High salinity from Suisun Bay intrudes into the Delta during periods of low Delta outflow. Salinity can adversely affect agricultural, M&I and recreational uses (Reclamation and DWR 2005).
- Delta exports contain elevated concentrations of disinfection by-product precursors (e.g., dissolved organic carbon (DOC)), and the presence of bromide increases the potential for formation of brominated compounds in treated drinking water (Reclamation and DWR 2005).
- Agricultural drainage in the Delta contains high levels of nutrients, suspended solids, DOC and minerals (salinity), as well as agricultural chemicals (pesticides) (Reclamation and DWR 2005).
- Synthetic and natural contaminants have bioaccumulated in Delta fish and other aquatic organisms. Synthetic organic chemicals and heavy metals are found in Delta fish in quantities occasionally exceeding acceptable standards for food consumption (Reclamation and DWR 2005).
- The San Joaquin River delivers water of relatively poor quality to the Delta, with agricultural drainage to the river being a major source of salts and pollutants. Because the south Delta receives a substantial portion of water from the San Joaquin River, the influence of this relatively poor San Joaquin River water quality is greatest in the south Delta channels and in the CVP and SWP exports (Reclamation and DWR 2005).

Water quality in the Delta is governed in part by Delta hydrodynamics, which are highly complex. The northern Delta is dominated by the waters of the Sacramento River, which are of relatively low salinity; whereas the relatively higher salinity waters of the San Joaquin River dominate the southern Delta. The central Delta includes many channels where waters from the Sacramento and San Joaquin rivers and their tributaries converge.

The following brief description of the hydrodynamic conditions in the Delta provides the context for understanding potential effects to water quality that could result from implementation of the Proposed Yuba Accord. A discussion of general water quality in the Delta and water quality constituents of concern with respect to drinking water follows the description of Delta hydrodynamics.

The principal factors affecting Delta hydrodynamic conditions are: (1) river inflows from the San Joaquin and Sacramento River systems; (2) daily tidal inflows and outflows through the San Francisco Bay; and (3) export pumping from the south Delta through the Harvey O. Banks Pumping and Jones Pumping Plants. Because tidal inflows are approximately equivalent to tidal outflows during each daily tidal cycle, tributary inflows and export pumping are the principal variables that define the range of hydrodynamic conditions in the Delta. Freshwater flows into the Delta from three major sources: the Sacramento River, the San Joaquin River, and the eastside streams. The Sacramento River contributes about 77 percent of the freshwater flows, the San Joaquin River contributes roughly 15 percent, and streams on the east side provide the remainder. On average, 10 percent of the Delta inflow is withdrawn for local use, 30 percent is withdrawn for export by the CVP and SWP, 20 percent is required for salinity control, and the remaining 40 percent provides outflow to the San Francisco Bay ecosystem in excess of minimum identified requirements (CALFED 2000).

Flows that enter the Delta via the Sacramento River take various routes to the export pumps in the southern Delta. Some of this flow is drawn to the CVP and SWP pumps through interior Delta channels, facilitated by the CVP's Delta Cross Channel. Water that does not travel into the Central Delta continues towards the San Francisco Bay. Under certain conditions, additional Sacramento River waters flow into the Central and South Delta. The Sacramento River waters flow through Three Mile and Georgiana sloughs, and around the western end of Sherman Island and up the San Joaquin River towards the export pumps. When freshwater outflow is relatively low, water with a higher salt concentration enters the Central and South Delta as tidal inflow from the San Francisco Bay. When CVP and SWP exports cause flow from the Sacramento River to move toward the pumps, then "reverse flow" occurs in the lower San Joaquin River. Prolonged reverse flow has the potential to adversely affect water quality in the Delta and at the export pumps by increasing salinity unless Delta outflow is increased by the CVP and SWP to offset that effect (CALFED 2000; DWR and Reclamation 1996; SWRCB 1997).

9.1.3.1 DELTA DRINKING WATER QUALITY CONCERNS

The existing water quality constituents of concern in the Delta can be categorized broadly as metals, pesticides, nutrient enrichment and associated eutrophication, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon. Water quality constituents that are of specific concern with respect to drinking water, including salinity, bromide, and organic carbon, are described below. Water quality data for drinking water constituents of concern at selected stations in the Delta are presented in **Table 9-10**.

Table 9-10. Water Quality Data for Selected Stations Within the Delta

Water Quality Parameter	Sacramento River at Greene's Landing	North Bay Aqueduct at Barker Slough	SWP Clifton Court Forebay	CVP Jones Pumping Plant	Contra Costa Intake at Rock Slough	San Joaquin River at Vernalis
Mean TDS (mg/l)	100	192	286	258	305	459
Mean Bromide, Dissolved (mg/l)	0.018	0.015	0.269	0.269	0.455	0.313
Mean Dissolved Organic Carbon (mg/l)	2.5	5.3	4.0	3.7	3.4	3.9
Mean Chloride, Dissolved (mg/l)	6.8	26	77	81	109	102
Electrical Conductivity (µS/cm)	160	332	476	482	553	749

SALINITY

High salinity can have a detrimental effect on agricultural production and can cause health and aesthetic (taste) concerns in drinking water. Salinity is particularly problematic because it is not removed through conventional drinking water treatment processes (CCWD and Reclamation 2006).

Salinity is a measure of the mass fraction of salts, measured in ppt. TDS are a measure of the concentration of salt, as measured in mg/l (DWR 2001b). Electrical conductivity is a measure of the ability of a solution to carry a current and depends on the type and total concentration of ionized substances dissolved in the water. Because EC of water generally changes proportionately to changes in dissolved salt concentrations, EC is a convenient surrogate measure for TDS and these terms are used somewhat interchangeably below.

Table 9-10 indicates that mean TDS concentrations are highest in the west Delta (Sacramento River at Green's Landing/Hood) and the south Delta channels (SWP Clifton Court Forebay), which are affected by the San Joaquin River (CALFED 2000). The quality shown in Table 9-10 for the SWP Clifton Court Forebay and at the CVP Jones Pumping Plant intake is affected by intrusion of saline water from the San Francisco Bay system and by San Joaquin River inflow into the Delta. The extent of seawater intrusion into the Delta is a function of daily tidal fluctuations, the inflows to the Delta from the Sacramento and San Joaquin rivers, the rate of export at the SWP and CVP intake pumps, and the operation of various control structures such as the Delta Cross-Channel Gates and Suisun Marsh Salinity Control System (DWR 2001b). In the southern Delta, salinity is largely associated with the high concentrations of salts carried by the San Joaquin River into the Delta (SWRCB 1997). The high mean concentration of TDS in the San Joaquin River at Vernalis reflects the accumulation of salts in agricultural soils and the impacts of recirculation of salts exported from the Delta via the Delta-Mendota Canal (CALFED 2000). Locations in the north portion of the Delta at Barker Slough, which is not substantially affected by seawater intrusion, and in the Sacramento River at Greene's Landing have lower mean concentrations of TDS. A similar pattern is seen using mean EC levels as a surrogate for TDS.

Salinity patterns in the Delta also vary with water year type (DWR 2001b). As shown in **Figure 9-1**, salinity as measured by EC, is higher in dry years than in wet years (DWR 2001b). For the purpose of Figure 9-1, wet years are a combination of wet and above normal water year types and dry years are a combination of dry and critical water year types (DWR 2001b).

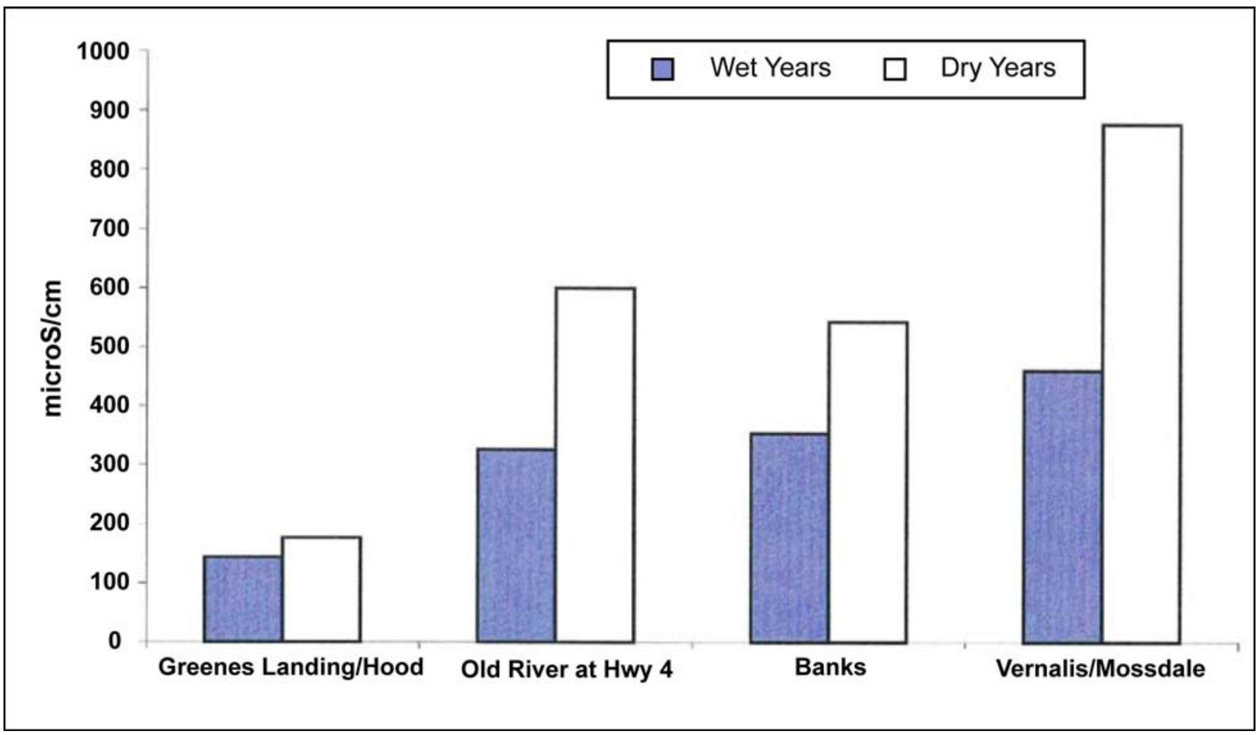

Figure 9-1. Average Electrical Conductivity (µS/cm) by Water Year Type at Selected Sites in the Delta

Note: Most samples collected monthly between 1990 and 1998. Source: (DWR 2001b)

Water quality data collected between 1996 and 1999 show that TDS levels at Banks Pumping Plant, in the Sacramento River at Hood, and in the western Delta at Old River at Highway 4 never exceeded the secondary MCL for drinking water of 500 mg/l (**Table 9-11**) (DWR 2001b). In the San Joaquin River near Vernalis, only 6 out of the 143 samples exceeded the secondary MCL for TDS. The secondary MCL for chloride is 250 mg/l, and the secondary MCL for EC is 900 µS/cm. Because TDS is a measure of the total dissolved solids and does not measure the relative contribution of individual constituents such as chloride and bromide, it is possible for water to meet the secondary TDS MCL for (500 mg/l) but still exceed a standard for an individual salt constituent such as chloride (250 mg/l) (DWR 2001b). Because of this and because of their importance in formation of disinfection byproducts (DBP), chloride bromide concentrations are addressed in detail in the following sections.

Table 9-11. Comparison of Total Dissolved Solids Concentrations at Selected Stations Within the Delta

TDS (mg/l)	Sacramento River at Greene's Landing/Hood	Old River at Highway 4	Banks Pumping Plant	San Joaquin River Near Vernalis/ Mossdale
Mean	95	200	195	273
Median	92	173	182	261
Low	50	107	116	83
High	404	450	388	578
# of Detects/Samples	131/131	40/40	27/27	143/143

CHLORIDE

Chloride is a major constituent of surface waters. It is normally present in low concentrations in freshwater surface environments, while groundwater will contain varying amounts of chloride depending on the surrounding geology. Chloride is widely distributed in the environment, generally as sodium chloride (NaCl), potassium chloride (KCl) and calcium chloride ($CaCl_2$). The weathering and leaching of sedimentary rocks and soils and the dissolution of salt deposits release chlorides into water. Chloride in the form of sodium chloride and calcium chloride is used extensively for snow and ice removal. In various other forms it has a number of commercial and industrial applications and is used in wastewater treatment.

Large concentrations of chloride can make water unusable for drinking and can also be toxic to plants. The EPA's secondary drinking water regulatory standard for chloride is 250 mg/l (EPA 2002), while chloride in concentrations as low as 106 mg/l may be toxic to some plants, and chloride at concentrations above 230 mg/l may affect freshwater aquatic life (RWQCB 2000). Chlorides also appear to exert a significant effect on the rate of corrosion of steel and aluminum and can therefore affect some metals used in water handling systems.

The seasonal changes in chloride concentrations at three locations are illustrated in **Figure 9-2** for the existing condition. The data represented in Figure 9-2 illustrate the median, 25th-percentile, and 75th-percentile chloride concentrations at the Banks Pumping Plant (Clifton Court), the Jones Pumping Plant, and the Los Vaqueros Old River Intake for each month of the year. The lowest median concentrations of chloride typically occur in spring and early summer (March through July). The long-term monthly median concentrations of chloride for the simulation period occurring under the existing condition do not exceed the secondary MCL for chloride of 250 mg/l.

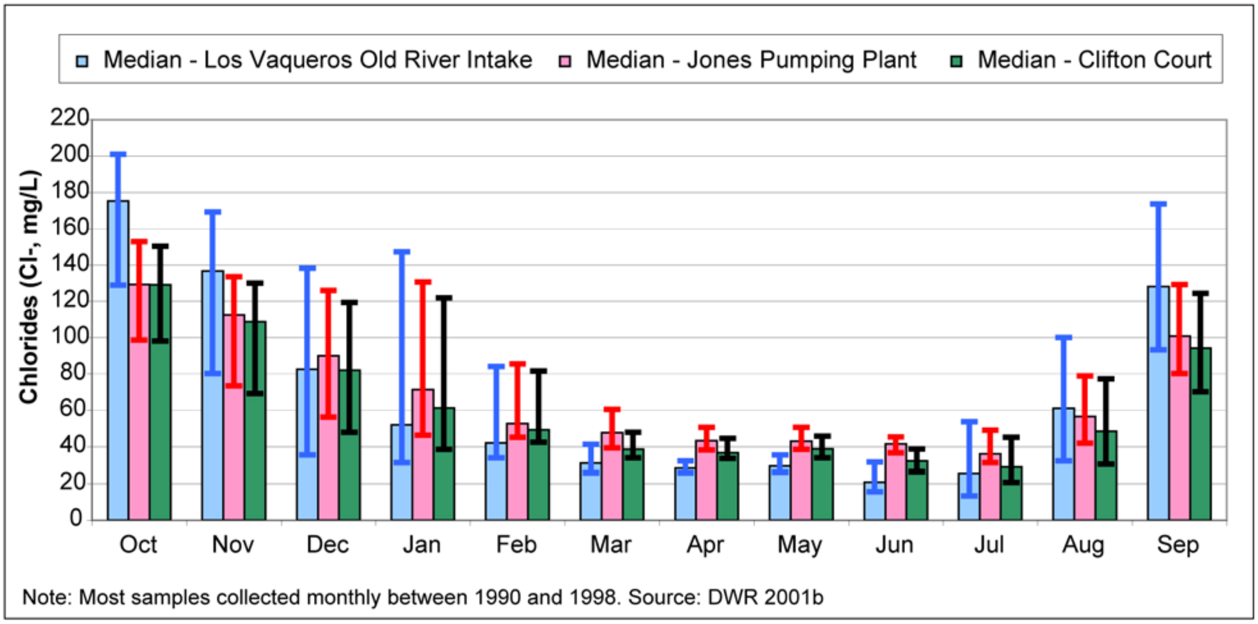

Figure 9-2. Long-term Monthly Median Concentrations of Chloride at Banks Pumping Plant (Clifton Court), Jones Pumping Plant, and the Los Vaqueros Old River Intake Under Existing Conditions

Note: Most samples collected monthly between 1990 and 1998. Error bars represent the 25th percentile and 75th percentile chloride concentrations. Source: (DWR 2001b)

BROMIDE

Bromides are formed by the reaction of bromine or a bromide with another substance and are widely distributed in nature (Columbia Encyclopedia Website 2005). For example, magnesium bromide, found in seawater, is a source of pure bromine (Columbia Encyclopedia Website 2005). Bromide is important from a drinking water perspective because, during chlorination for disinfection of drinking water, bromide reacts with natural organic compounds in the water to form trihalomethanes (THMs). Four species of THMs are regulated in drinking water: chloroform, bromodichloromethane, dibromochloromethane, and bromoform.

The recently announced requirements under the Stage 1 D/DBPR require lower levels of bromate in drinking water (0.010 mg/l) than previously required (63 FR 69390, December 16, 1998). The LT1ESWTR requires additional disinfection, primarily pathogens such as *Cryptosporidium* and *Giardia* (67 FR 1812 (January 14, 2002)), and the requirement for increased disinfection has the potential to increase the quantity of disinfection by-product formed during disinfection. Agencies that use ozone for disinfection find that when bromide is in source water, ozone treatment also causes the formation of bromate. Hence, the requirement for increased disinfection has the potential to increase the quantity of disinfection by-product formed during disinfection and, in order to meet EPA drinking water standards, CALFED has proposed that the concentration of bromide levels at export pumps not exceed 0.05 mg/l (DWR 2001b). However, this recommendation is a non-enforceable target level.

The primary source of bromide in Delta waters is seawater intrusion (CALFED 2000). Other sources of bromide include drainage returns in the San Joaquin River and within the Delta, connate water beneath some Delta Islands, and possibly agricultural applications of methyl bromide (CALFED 2000). The San Joaquin River and agricultural irrigation sources are primarily a “recirculation” of bromide that originated from seawater intrusion (CALFED 2000). As shown in Figure 9-2, TDS, EC, bromide and chloride data indicate that seawater intrusion is highest in the western and southern portions of the Delta, where the direct impacts of seawater intrusion and the impacts of recirculated bromide from the San Joaquin River exist (DWR 2001b).

In addition to varying geographically within the Delta, bromide varies seasonally, in a pattern similar to that exhibited by salinity. The data represented in **Figure 9-3** illustrate the median, 25th-percentile, and 75th-percentile bromide concentrations at the Banks Pumping Plant (Clifton Court), the Jones Pumping Plant, and the Los Vaqueros Old River Intake for each month of the year. The lowest median concentrations of bromide typically occur in spring and early summer (March through July).

In the Delta, water year has a strong influence on bromide concentration (DWR 2001b). **Figure 9-4** illustrates that from 1990 to 1998, average bromide concentrations at four locations were higher in dry years than in wet years (DWR 2001b). For the purpose of Figure 9-4**,** wet years are a combination of wet and above normal water year types and dry years are a combination of dry and critical water year types (DWR 2001b).

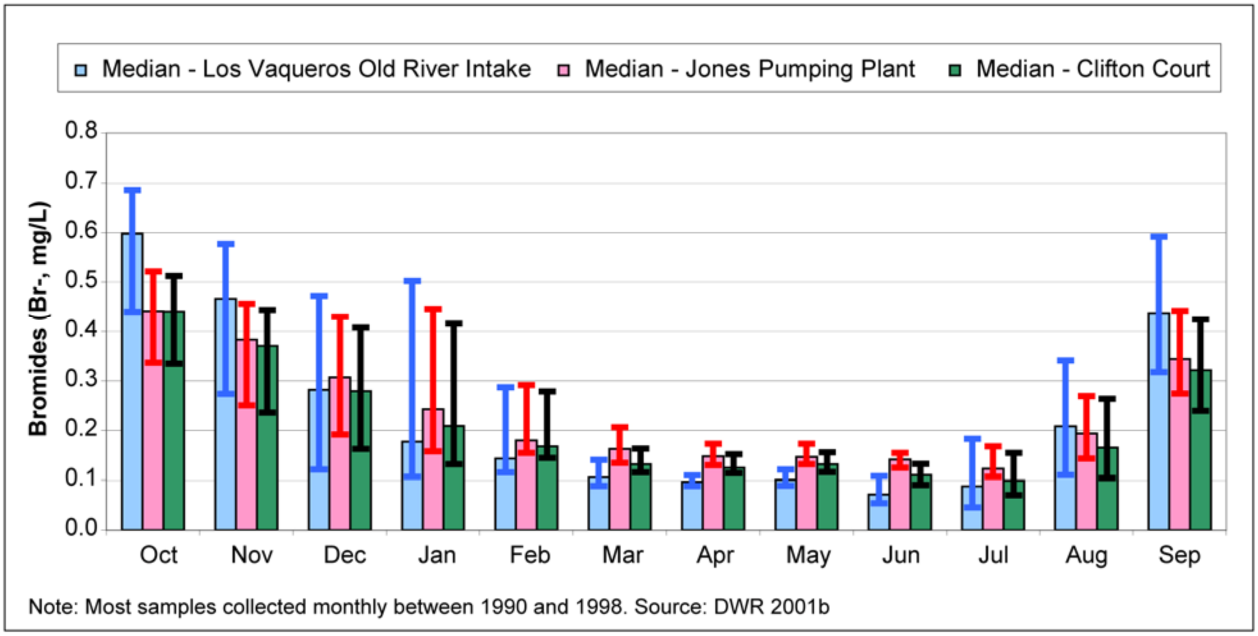

Figure 9-3. Long-term Monthly Median Concentrations of Bromide (mg/l) at Banks Pumping Plant (Clifton Court), Jones Pumping Plant, and the Los Vaqueros Old River Intake Under Existing Conditions

Note: Most samples collected monthly between 1990 and 1998. Error bars represent the 25th percentile and 75th percentile bromide concentrations. Source: (DWR 2001b)

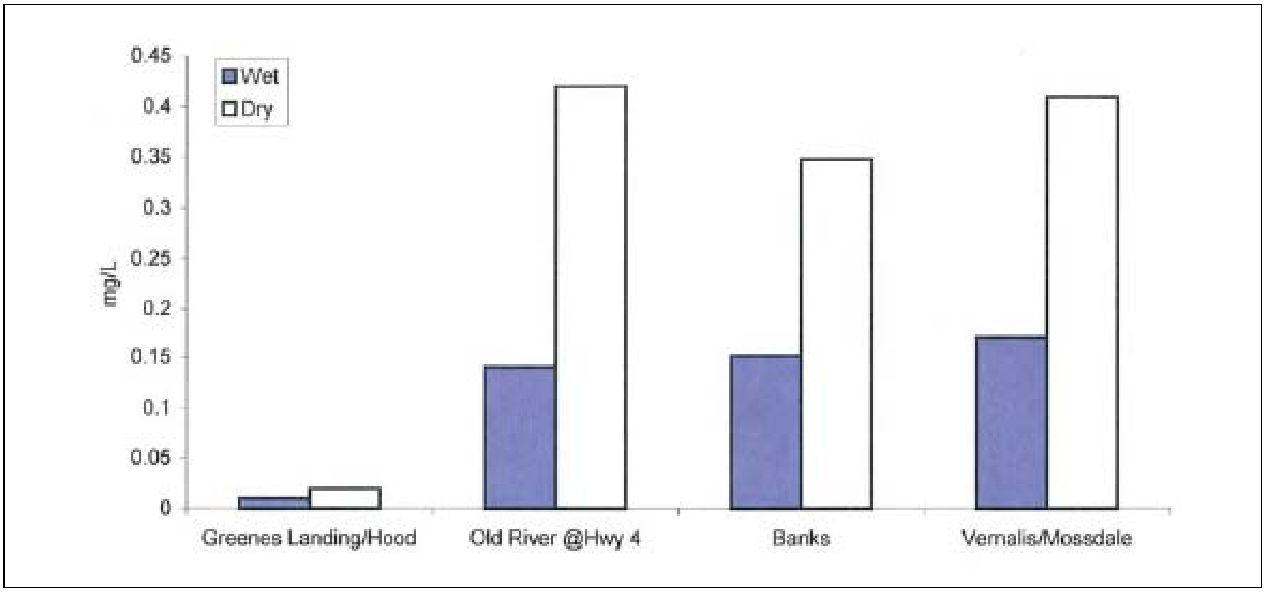

Figure 9-4. Average Bromide Concentrations (mg/l) by Water Year Type at Selected Sites in the Delta

Note: Most samples collected monthly between 1990-1998. Source: (DWR 2001b).

ORGANIC CARBON

Naturally occurring organic compounds are present in surface waters as a result of degradation of aquatic vegetation and animal tissues. Scientists measure organic carbon using several methods. DOC is a measure of the DOC in the water, while TOC is a measure of all the organic carbon in the water, including organic carbon from particulate matter such as plant residue and DOC. Naturally occurring organic compounds, mainly humic and fulvic acids resulting from plant decay, are generally referred to as organic THM precursors. Organic carbon is important because of its role in the formation of DBPs, specifically THMs, as well as the methylation of mercury.

There is generally limited knowledge of TOC levels at key Delta locations and tributaries, and limited understanding of TOC and DOC loads in the Delta system (DWR 2001b). With this caveat stated, there is some available data and information describing TOC and DOC concentrations in the Delta. Major sources of DOC and TOC to the Delta include the Sacramento River, the San Joaquin River, and in-Delta island drainage return flows (CALFED 2000). Of the DOC loading contributed by tributary inflow, the Sacramento River is the major contributor to the Delta carbon load, contributing an estimated 71 percent of the total carbon load attributed to tributary inflow in the Delta (DWR 2001b). The Sacramento River is a major contributor because although its carbon concentrations are relatively low, approximately three-quarters of the inflow to the Delta come from the Sacramento River (DWR 2001b). The San Joaquin River contributes approximately 20 percent of the total carbon load attributed to tributary inflow in the Delta (DWR 2001b). Drainage from Delta islands, particularly islands with highly organic peat soils, contributes significantly to the DOC load in the Delta (DWR 2001b). Studies conducted by the DWR suggest that during the winter, 38 to 52 percent of the DBP-forming carbon in the Delta is contributed by Delta island drainage, while in the summer during irrigation, island drainage contributes between 40 to 45 percent of the DBP-forming carbon (DWR 2001b). In general, monitoring data suggests that most of the TOC in the Delta is in the form of DOC (CALFED 2000).

As with salinity and bromide, organic carbon concentrations in the Delta vary both geographically and seasonally. Organic carbon patterns in the Delta, however, are somewhat different from salinity and bromide patterns in the Delta. Like salinity and bromide, organic carbon concentrations are higher in west and south Delta locations (Station 9, the San Joaquin River near Vernalis, and Banks Pumping Plant) than in the Sacramento River at Greene's Landing/Hood. Unlike salinity and bromide concentrations, organic carbon concentrations are typically lowest in the summer and higher during the rainy winter months.

9.1.4 EXPORT SERVICE AREA

Because the reservoirs within the CVP/SWP system are operated in a coordinated manner to the various demands throughout California, changes in the timing and magnitude of exports from the Delta could indirectly result in changes to Delta flows and water surface elevations in San Luis Reservoir.

9.1.4.1 SAN LUIS RESERVOIR

Jointly owned by Reclamation and DWR, San Luis Reservoir is one of California's largest reservoirs and a key component of the state's water supply system (CALFED Bay-Delta Program 2003). With a storage capacity of more than 2 MAF, San Luis Reservoir is an off-stream water storage facility that is used to store and re-regulate CVP and SWP water from the Delta. DWR is responsible for the daily operation of the reservoir; however, operational decisions are coordinated with Reclamation and the CVP. San Luis Reservoir is operated by filling the reservoir during the wetter winter months and releasing stored water during the drier summer months. Drawdown typically begins in March and reaches the late summer/early fall low point in August or September. Water levels in the reservoir typically reach their annual low point in late summer or early fall, when CVP and SWP contractors' water demands are at their peak (CALFED Bay-Delta Program 2003).

During the summer months when water levels are low, water quality may deteriorate due to a combination of higher water temperatures, wind-induced nutrient mixing, and algal blooms near the reservoir surface. The reservoir also has an unusual configuration with a very large surface area and a relatively shallow depth, which is a contributing factor in algal bloom formation and persistence. The low point begins to affect San Felipe Division operations when water levels in the reservoir decrease to an elevation of about 406 feet msl, corresponding to a storage capacity of about 571 TAF. At this elevation, summer algal growth that develops at the reservoir's surface and extends to depths of 30 feet or more may begin to be drawn into the upper intake of the Pacheco Pumping Plant, located at an elevation of 376 feet msl. Consequently, when the water level approaches an elevation of 406 feet msl, the upper Pacheco intake is shut off manually to avoid adverse effects on the quality of San Felipe Division water supply. When the water level reaches the "low-point" at approximately 369 feet msl, corresponding to about 300 TAF capacity, algae may begin to enter the lower Pacheco intake. At these lower water levels, the concentration of algae in water drawn into the Pacheco Pumping Plant may be so high that the water is untreatable, and water supply may be interrupted as a result of poor water quality (CALFED Bay-Delta Program 2003).

Historically, the CVP and SWP have cooperated to try to maintain storage in San Luis Reservoir above 300 TAF in response to the low-point problem; as a result, approximately 200 TAF of water stored in the reservoir remains unavailable to state and federal users each year. This problem is expected to worsen in coming years as pressure to use all of the water stored in the reservoir increases and new measures for environmental and fish habitat protection further restrict the amount of water that can be exported from the Delta for storage in San Luis Reservoir (CALFED Bay-Delta Program 2003).

9.1.5 REGULATORY SETTING

Responsibility for surface water quality in California is shared between agencies. The SWRCB is responsible for the water rights and water quality functions of the state. The CDHS issues permits to domestic water suppliers for use of surface water or groundwater as a drinking water source. DWR and Reclamation, as operators of the CVP and SWP, are responsible for meeting water quality requirements in the Delta. Additionally, effluent discharges from wastewater treatment facilities contribute to increased flows in several of the project study area streams, which are regulated by various federal and state laws, regulations, and policies that affect instream conditions and facility operations.

9.1.5.1 FEDERAL

CLEAN WATER ACT

The CWA is a comprehensive set of statutes aimed at restoring and maintaining the chemical, physical and biological integrity of the nation's waters. The CWA is the foundation of surface water quality protection in the United States[2]. The CWA does not directly address groundwater or water quantity issues.

Initial authority for the implementation and enforcement of the CWA rests with the EPA; however, this authority can be exercised by states with approved regulatory programs, and, in California, this authority is exercised by the SWRCB and the RWQCBs. The CWA contains a variety of regulatory and non-regulatory tools to significantly reduce direct pollutant discharges into waters of the United States, to finance municipal wastewater treatment facilities, and to manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters so that they can support "*the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water*."

Section 303(d) of the federal CWA requires states to identify water bodies that do not meet water quality standards and are not supporting their designated beneficial uses. These waters are placed on the Section 303(d) List of Impaired Water Bodies. This list defines low, medium, and high priority pollutants that require immediate attention by state and federal agencies. Placement on this list triggers development of a TMDL program for each water body and associated pollutant/stressor on the list.

The Central Valley RWQCB is responsible for implementing the TMDL program for both the regional and local study areas. Monitoring of chemicals within sediments and surface waters in the regional and local study areas is ongoing and additional TMDLs may be developed in the future. Currently, within the regional study area, TMDLs have been developed for some of the water bodies listed in **Table 9-12**.

[2] http://www.epa.gov/watertrain/cwa/

Table 9-12 List of Stressors and Impaired Water Bodies in the Regional Study Areas

Chemical Stressors	Yuba Region		CVP/SWP Upstream of the Delta Region			Delta Region		Export Service Area
	New Bullards Bar Reservoir	Lower Yuba River	Oroville Reservoir	Lower Feather River	Sacramento River	Delta Waterways (Eastern Portion)	Delta Waterways (Western Portion)	San Luis Reservoir
Diazinon				✓	✓	✓	✓	
Chlorphyrifos						✓	✓	
DDT						✓	✓	
Group A Pesticides				✓		✓	✓	
Mercury				✓	✓	✓	✓	
Cadmium, Copper, Zinc								
Organic Enrichment/ Low Dissolved Oxygen						✓		
Electrical Conductivity							✓	
Unknown Toxicity				✓	✓	✓	✓	

Source: (SWRCB Website 2006a).
Group A Pesticides: aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan, and toxaphene.

To date, no TMDLs have been developed or suggested for the Yuba River or San Luis Reservoir. However, there are plans to develop a TMDL for pH in Deer Creek, a tributary to the Yuba River in the near future (SWRCB Website 2006a). Future TMDL programs for the reductions of total mercury loads exported from tributary watersheds upstream of the Delta are currently being evaluated by the SWRCB (RWQCB 2006).

Constituents of Concern

Various water bodies within the local and regional study areas have been identified as impaired for certain constituents, as listed on the 303(d) list under the CWA. CWA Section 303(d) requires states to identify waters that do not meet applicable water quality standards after the application of certain technology-based controls. As defined in the CWA and federal regulations, water quality standards include the designated uses of a water body, the adopted water quality criteria, and the state's anti-degradation policy. As defined in the Porter-Cologne Water Quality Control Act, water quality standards are beneficial uses to be made of a water body, the established water quality objectives (both narrative and numeric), and the state's non-degradation policy (SWRCB Resolution No. 68-16).

Certain water bodies in the regional study area are listed as water quality limited (impaired) for one or more of the constituents of concern. Based on RWQCB plans for the Bay-Delta Estuary (Region 2) and the Central Valley Basin (Region 5), information on the constituents of concern for listed water bodies, potential sources for each constituent, and proposed TMDL completion dates are presented in **Table 9-13**. In addition to constituents of concern for 303(d) listed water bodies, there are water quality constituents of concern with respect to drinking water. Water quality constituents of concern for drinking water that are relevant to the SRWRS are DBP precursors. DBPs are formed during the disinfection of surface waters with an oxidant, such as chlorine, chloramines or ozone, when certain precursors (i.e., total organic carbon and bromide) are present in sufficient quantity.

Table 9-13. Constituents of Concern for 303(d) Listed Water Bodies in the Project Study Area

Name	Constituent	Potential Sources	Proposed TMDL Completion Year
Sacramento River	Mercury Unknown toxicity	Resource Extraction Source Unknown	2019 2019
Lower Feather River	Chlorphyrifos Group A Pesticides 1 Mercury Unknown Toxicity	Agriculture Resource Extraction Source Unknown	2019 2011 2009 2019
Lower American River	Mercury Unknown Toxicity	Resource Extraction Source Unknown	2008 2019
Delta	Chlordane DDT Dieldrin Dioxin Compounds (including 2,3,7,8-TCDD) Exotic Species Furan Compounds Mercury Nickel PCBs (Polychlorinated biphenyls) PCBs (Polychlorinated biphenyls) (dioxin-like)	Nonpoint Source Nonpoint Source Nonpoint Source Atmospheric deposition Ballast Water Atmospheric Deposition Industrial Point Sources/ Municipal Point Sources/ Resource Extraction/ Atmospheric Deposition/ Nonpoint Sources Source Unknown Unknown Nonpoint Source Unknown Nonpoint Source	2008 2008 2008 2019 2019 2019 2006 2019 2006 2019
Source: (SWRCB Website 2006b)			

Beneficial Uses

Beneficial uses are critical to water quality management in California. State law defines beneficial uses of California's waters that may be protected against quality degradation to include (but not limited to) "*...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves*" (Water Code Section 13050(f)). Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning. Significant points concerning the concept of beneficial uses are:

- All water quality problems can be stated in terms of whether there is water of sufficient quantity or quality to protect or enhance beneficial uses (RWQCB 1998).
- Beneficial uses do not include all of the reasonable uses of water. For example, disposal of wastewaters is not included as a beneficial use. This is not to say that disposal of wastewaters is a prohibited use of waters of the state; it is merely a use, which cannot be satisfied to the detriment of beneficial uses. Similarly, the use of water for the dilution of salts is not a beneficial use although it may, in some cases, be a reasonable and desirable use of water (RWQCB 1998).
- The protection and enhancement of beneficial uses require that certain quality and quantity objectives be met for surface water and groundwater (RWQCB 1998).
- Fish, plants, and other wildlife, as well as humans, use water beneficially.

The beneficial uses designated for waters within the Delta regional study area are presented in **Table 9-14**. The beneficial uses of any specifically identified water body generally apply to its tributary streams. In some cases, a beneficial use may not be applicable to the entire body of water. In these cases, the RWQCB's judgment is applied. Water bodies within the basins that do not have beneficial uses designated are assigned municipal and domestic supply (MUN) designations in accordance with the provisions of SWRCB Resolution No. 88-63. These MUN designations in no way affect the presence or absence of other beneficial uses in these water bodies.

Table 9-14. Beneficial Uses of Water Bodies in the Delta

Beneficial Use Designation	Delta Inland Surface Waters	San Francisco Bay Estuary	Coastal Waters
Municipal and Domestic Supply	✓	✓	
Irrigation Watering	✓	✓	
Stock Watering			
Industrial Process	✓	✓	✓
Service Supply			
Groundwater Recharge	✓	✓	
Power Generation			
Water Contact Recreation	✓	✓	✓
Non-contact Water Recreation	✓	✓	✓
Warm Freshwater Habitat	✓	✓	
Cold Freshwater Habitat	✓	✓	
Fish Migration	✓	✓	
Fish Spawning Habitat	✓		
Navigation		✓	✓
Wildlife Habitat	✓	✓	
Estuarine Habitat		✓	
Shellfish Harvesting			✓
Ocean, Commercial and Sport Fishing			✓
Preservation of Rare and Endangered Species			✓
Marine Habitat			✓
Source: (RWQCB 1998)			

Section 401 of the Clean Water Act

Section 401 of the CWA (33 USC § 1311) provides for water quality certifications for discharges of pollutants into navigable waters under Sections 402 and 404 of the CWA (33 USC § 1342 and 1344). If new structures (e.g., treatment plants) are proposed, that would discharge effluent into navigable waters, relevant permits under the CWA would be required for the Project applicant(s). Section 401 requires any applicant for an individual Corps dredge and fill discharge permit to first obtain certification from the state that the activity associated with dredging or filling would comply with applicable state effluent and water quality standards. This certification must be approved or waived prior to the issuance of a permit for dredging and filling.

Section 404 of the Clean Water Act

Section 404 of the CWA authorizes the Corps to issue permits to regulate the discharge of "*dredged or fill materials into waters of the United States*" (33 USC § 1344). Should activities such as dredging or filling of wetlands or surface waters be required for project implementation, then permits obtained in compliance with CWA Section 404 would be required for the project applicant(s).

SAFE DRINKING WATER ACT

The Safe Drinking Water Act (SDWA) was passed in 1974 to regulate the nation's drinking water supply. Amended in 1986 and 1996, the federal law requires many actions to protect drinking water and its sources (e.g., rivers, reservoirs and groundwater). The SDWA (40 CFR 141-143) only applies to surface water if the water is to be used for human consumption.

The SDWA authorizes the EPA to set and implement national health-based standards to protect against both naturally occurring and man-made contaminants that may be found in drinking water. These National Primary Drinking Water Regulations set enforceable MCLs for particular contaminants in drinking water, or required ways to treat water to remove contaminants. Both "primary" and "secondary" drinking water standards have been developed. Defined as the "*highest level of a contaminant permissible in water in a public water system,*" primary MCLs address health concerns, while secondary MCLs address esthetics, such as taste and odor. Primary MCLs have been set for over 90 potential drinking water contaminants. Secondary standards are not federally enforceable, but are guidelines for state use.

Amendments to the SDWA in 1996 require the EPA to develop rules to balance the risks between microbial pathogens and DBPs. The Stage 1 Disinfectants and Disinfection Byproducts Rule, announced in December 1998, was the first of a set of rules under the 1996 SDWA amendments. The Stage 1 Disinfectants and Disinfection Byproducts Rule applies to all community and nontransient noncommunity water systems that treat their water with a chemical disinfectant for either primary or residual treatment. The rule establishes maximum residual disinfectant level goals and maximum residual disinfectant levels for three chemical disinfectants, including chlorine, chloramine and chlorine dioxide. It also establishes maximum contaminant level goals and MCLs for total THMs, haloacetic acids, chlorite and bromate (Sacramento County Water Agency 2003).

SURFACE WATER TREATMENT RULE

In 1989, the Surface Water Treatment Rule (SWTR) was adopted in response to concerns over the presence of high concentrations of pathogenic organisms in source surface waters (US EPA 1989, Final Surface Water Treatment Rule, Federal Register 54, 124, 27486). The California Surface Water Treatment Rule (California SWTR), which implements the federal SWTR within California, became effective in June 1991 (see California Safe Drinking Water Act discussion below).

Amendments to the SDWA in 1996 require the EPA to develop rules to balance the risks between microbial pathogens and DBPs. The Interim Enhanced Surface Water Treatment Rule amends the existing Surface Water Treatment Rule to strengthen microbial protection, including provisions specifically to address *Cryptosporidium*, and to address risk trade-offs with DBPs (EPA Website 2006a). The Interim Enhanced Surface Water Treatment Rule applies to public water systems that use surface water or groundwater under the direct influence of surface water (GWUDI) and serve at least 10,000 people. In addition, states are required to conduct sanitary surveys for all surface water and GWUDI systems, including those that serve fewer than 10,000 people. The final rule includes treatment requirements for waterborne pathogens (e.g., *Cryptosporidium*). In addition, systems must continue to meet existing requirements for *Giardia lamblia* and viruses. Specifically, the rule includes:

- Maximum contaminant level goal of zero for *Cryptosporidium;*
- 2-log *Cryptosporidium* removal requirements for systems that filter;
- Strengthened combined filter effluent turbidity performance standards;
- Individual filter turbidity monitoring provisions;

- Disinfection profiling and benchmarking provisions;
- Systems using groundwater under the direct influence of surface water now subject to the new rules dealing with *Cryptosporidium;*
- Inclusion of *Cryptosporidium* in the watershed control requirements for unfiltered public water systems;
- Requirements for covers on new finished water reservoirs; and
- Sanitary surveys conducted for all surface water systems regardless of size.

Additionally, Congress approved a second phase of rule amendments including the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) (71 FR 654 (January 5, 2006)) and the Stage 2 Disinfection Byproduct Rule (71 FR 388 (January 4, 2006)). The LT2 rule supplements existing regulations by targeting additional Cryptosporidium treatment requirements to higher risk systems. This rule also contains provisions to reduce risks from uncovered finished water reservoirs and to ensure that systems maintain microbial protection when they take steps to decrease the formation of DBPs that result from chemical water treatment (EPA Website 2006b). The Stage 2 DBP rule is one part of the Microbial and Disinfection Byproducts Rules, which are a set of interrelated regulations that address risks from microbial pathogens and disinfectants/disinfection byproducts. The Stage 2 DBP rule focuses on public health protection by limiting exposure to DBPs, specifically total THMs and five haloacetic acids, which can form in water through disinfectants used to control microbial pathogens. This rule will apply to all community water systems and nontransient noncommunity water systems that add a primary or residual disinfectant other than ultraviolet (UV) light or deliver water that has been disinfected by a primary or residual disinfectant other than UV (EPA Website 2006b).

9.1.5.2 STATE

PORTER-COLOGNE ACT

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act), enacted in 1969 and amended in 2005, specifies requirements for water quality protection in California. Under the Porter-Cologne Act, the SWRCB is required to adopt water quality policies, plans, and objectives that protect state waters for public use and enjoyment. State agencies charged with the primary responsibilities of water quality protection and CWA implementation under the Porter-Cologne Act include the SWRCB and the RWQCBs. In their respective regions, the RWQCBs engage in several water quality functions. One of the most important is preparing and periodically updating WQCPs, which specify the beneficial uses to be protected within a particular region. RWQCBs also regulate all pollutant or nuisance discharges that may affect either surface water or groundwater, including non-point source discharges to surface water. Additionally, the SWRCB, in acting on water rights applications, may establish terms and conditions in water rights permits to help implement water quality control plans.

CALIFORNIA SAFE DRINKING WATER ACT

The CDHS is designated by the EPA as the primary agency to administer and enforce the requirements of the federal SDWA in California. Public water systems are required to monitor for regulated contaminants in their drinking water supply. California's drinking water standards (e.g., MCLs) are the same or more stringent than the federal standards, and include additional contaminants not regulated by the EPA. Like the federal MCLs, California's primary

MCLs address health concerns, while secondary MCLs address esthetics, such as taste and odor. The California SDWA is administered by CDHS primarily through a permit system.

DRINKING WATER SUPPLY PERMITS

Under the California SDWA, with some exceptions, water supply permits are required for drinking water supply systems. Water supply permit applications must demonstrate that source water quality can be treated to drinking water standards. Water quality provisions within the permit are enforceable by the CDHS or a county agency with delegated authority.

RECREATIONAL USE PERMITS FOR DOMESTIC WATER SUPPLY RESERVOIRS

Recreational use of reservoirs can add pathogenic organisms, petroleum products and byproducts, personal hygiene products and other chemicals that affect water quality, decreasing the reservoir's suitability for as drinking water source. Except for SWP reservoirs and a few other specific reservoirs, a drinking water regulation prohibits recreational use of a domestic water supply reservoir unless it is specifically authorized in a water supply permit (CCR, Title 17, Section 7627). The CCR also establishes minimum data requirements to accompany an application for recreational use. Body contact recreation is allowed on SWP reservoirs to the extent that it is compatible with public health and safety (Water Code, Section 12944(a)).

WATER QUALITY CONTROL PLAN REQUIREMENTS AND REGIONAL WATER QUALITY CONTROL BOARD AUTHORITIES

The preparation and adoption of WQCPs (or Basin Plans) is required by the Water Code and Section 303 of the CWA, which requires states to adopt water quality standards that "*consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses.*" According to Section 13050 of the Water Code, Basin Plans consist of a designation or establishment of beneficial uses to be protected for the waters within a specified area, water quality objectives to protect those uses, and a program of implementation needed for achieving the objectives. State law also requires that Basin Plans conform to the policies set forth in the Water Code beginning with Section 13000 and any state policy for water quality control. Because beneficial uses, together with their corresponding water quality objectives, can be defined per federal regulations as water quality standards, the Basin Plans are regulatory references for meeting the state and federal requirements for water quality control (40 CFR 131.20). One significant difference between the state and federal programs is that California's basin plans establish standards for groundwater in addition to surface water.

Basin Plans are adopted and amended by regional water boards under a structured process involving full public participation and state environmental review. Basin Plans and amendments thereto, do not become effective until approved by the SWRCB. The Office of Administrative Law must approve regulatory provisions. Adoption or revision of surface water standards is subject to the approval of the EPA.

Basin Plans complement other WQCPs adopted by the SWRCB, such as the WQCP for Temperature Control and Ocean Waters (RWQCB 1998; SWRCB 1998). The objectives of these plans also are set to protect beneficial uses of the water bodies including municipal uses such as drinking water. Two Basin Plans govern the water bodies within the area of analysis:

- The "*Water Quality Control Plan for the Sacramento River and San Joaquin River Basins*" covers areas within the California Central Valley; and

- The "*Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary*" for the Delta.

Adherence to the Basin Plan objectives allows for the continued use of the water bodies meeting the applicable water quality criteria, including drinking water treatment standards. It is the intent of the SWRCB and the RWQCBs to maintain the Basin Plans in updated and readily available editions that reflect the current water quality control program.

BASIN PLAN FOR THE SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA ESTUARY

The Bay-Delta WQCP (SWRCB and California Environmental Protection Agency 2006) establishes water quality control measures that contribute to the protection of the beneficial uses of the Bay-Delta Estuary. This plan supersedes both the WQCP for the Delta and Suisun Marsh, adopted August 1978 and the WQCP for Salinity for the Delta, adopted May 1991. As with other state water quality control plans, the Bay-Delta WQCP identifies the beneficial uses to be protected, the water quality objectives for reasonable protection of the beneficial uses, and a program of implementation for achieving the water quality objectives (Sacramento County Water Agency 2003).

The Bay-Delta Estuary is important to the natural environment and economy of California. The watershed of the Bay-Delta Estuary provides drinking water to two-thirds of California's population and water for a multitude of other urban uses. Additionally, it supplies some of California's most productive agricultural areas, both inside and outside of the Estuary. The Bay-Delta Estuary itself is one of the largest ecosystems for fish and wildlife habitat and production in the United States. However, historical and current human activities (e.g., water development, land use, wastewater discharges, introduced species, and fishery harvesting), exacerbated by variations in natural conditions, have degraded the beneficial uses of the Bay-Delta Estuary, as evidenced by the declines in the populations of many biological resources of the Estuary (San Francisco Bay RWQCB 2006; SWRCB and California Environmental Protection Agency 2006).

The Bay-Delta WQCP contains specific numeric standards for Delta inflow and outflow, chloride, and EC at various locations in the Delta. EC standards in the Delta exist for agricultural, fish, and wildlife beneficial uses. EC is a measure of water's ability to conduct an electric current, and is an indirect measure of the concentration of dissolved salts in water.

The Bay-Delta Estuary Plan provides the component of a comprehensive management package for the protection of the Estuary's beneficial uses that involves salinity (from saltwater intrusion and agricultural drainage) and water project operations (flows and diversions), as well as a dissolved oxygen objective. This plan supplements other WQCPs adopted by the SWRCB and RWQCBs, and state policies for water quality control adopted by the SWRCB that apply to the Bay-Delta Estuary watershed. These other plans and policies establish water quality standards and requirements for parameters such as toxic chemicals, bacterial contamination, and other factors which have the potential to impair beneficial uses or cause nuisances.

SWRCB DECISION 1641

The Basin Plan for the Bay-Delta Estuary (discussed above) contains current water quality objectives for the Delta. SWRCB D-1641 contains the current water right requirements to implement the Bay-Delta water quality objectives. D-1641 specifies that, from February through June, the location of X2 must be west of Collinsville and must additionally be west of Chipps

Island or Port Chicago for a certain number of days each month, depending on the previous month's Eight River Index[3]. D-1641 specifies that compliance with the X2 standard may occur in one of three ways, including: (1) the daily average EC at the compliance point is less than or equal to 2.64 microsiemens per centimeter (μS/cm); (2) the 14-day average EC is less than or equal to 2.64 mS/cm; or (3) the 3-day average Delta outflow is greater than or equal to the corresponding minimum outflow.

In D-1641, the SWRCB assigned responsibilities to Reclamation and DWR for meeting these requirements on an interim basis. These responsibilities required that the CVP and SWP be operated to meet water quality objectives in the Delta, pending a water rights hearing to allocate the obligation to meet the water quality and flow-dependent objectives among all users of the Sacramento and San Joaquin basins with appropriative water rights with post-1914 priority dates. However, in lieu of this hearing, the "*San Joaquin River Agreement*" and "*Sacramento Valley Water Management Agreement*" are settlements between Reclamation and DWR with upstream of the Delta water users, in which the CVP and SWP committed to continue to meet the D-1641 water quality requirements in return for other commitments by major upstream water-rights holders. After these agreements were executed, the SWRCB cancelled the water rights hearing to allocate that responsibility.

In February 2006, the SWRCB issued notice to DWR and Reclamation that each agency is responsible for meeting the objectives in the interior southern Delta, as described in D-1641. The SWRCB Order requires DWR and Reclamation to comply with a detailed plan and time schedule that will bring them into compliance with their respective permit and license requirements for meeting interior southern Delta salinity objectives by July 1, 2009. The SWRCB Order also revised the previously issued (July 1, 2005) Water Quality Response Plan (WQRP) approval governing Reclamation's and DWR's use of the other agency's respective point of diversion in the south Delta. Additionally, the Order specifies that JPOD operations are authorized pursuant to the 1995 WQCP and that Reclamation and DWR may conduct JPOD diversions, provided that both agency is in compliance with all of the conditions of their respective water right permits and license at the time that the JPOD diversions would occur (SWRCB 2006).

STATE AND FEDERAL WATER PROJECT WATER ACCEPTANCE CRITERIA

In consultation with the SWP contractors and the CDHS, DWR developed acceptance criteria to govern the water quality of non-Project water conveyed through the California Aqueduct. Non-project water with chemical concentrations less than the non-Project water acceptable criteria is routinely accepted by DWR. Non-project water with chemical concentrations greater than the criteria is managed on a case-by-case basis. Reclamation has developed a set of criteria for accepting groundwater into the Delta-Mendota Canal (Reclamation *et al.* 2003). However, because groundwater developed under the Proposed Project/Action will not be directly placed within the California Aqueduct or the Delta-Mendota Canal, these requirements do not apply to this project.

[3] The Eight River Index is defined in D-1641 as the sum of the unimpaired runoff as published in DWR Bulletin 120 for the following locations: (1) Sacramento River at Bend Bridge near Red Bluff; (2) Feather River (total inflow to Oroville Reservoir); (3) Yuba River at Smartville; (4) American River (total inflow to Folsom Reservoir); (5) Stanislaus River (total inflow to New Melones Reservoir); (6) Tuolumne River (total inflow to Don Pedro Reservoir); (7) Merced River (total inflow to Exchequer Reservoir); and (8) San Joaquin River (total inflow to Millerton Lake).

POLICY FOR IMPLEMENTATION AND ENFORCEMENT OF THE NONPOINT SOURCE POLLUTION CONTROL PROGRAM (WATER CODE SECTION 13369 (A)(2)(B))

Agricultural return flows include, flows from tile drains, and irrigation and storm water runoff. These discharges can affect water quality by transporting pollutants including pesticides, sediments, and nutrients, from cultivated fields into surface water. Many surface water bodies are impaired because of pollutants from agricultural sources. Groundwater bodies within California's agricultural areas have also suffered pesticide, nitrate and salt contamination.

Historically, most Regional Boards regulated these discharges under waivers, as authorized by Water Code Section 13269, and other administrative tools were seldom used. Section 13269 allows the Regional Boards to waive the requirement for waste discharge requirements if it is in the public interest (Gerstein *et al.* 2005). Although waivers were always conditional, the historical waivers had few conditions. In general, they required that discharges not cause violations of water quality objectives, but did not require water quality monitoring.

In May 2004, the SWRCB adopted a new policy regulating non-point source (NPS) pollution, known as the "*Policy for Implementation and enforcement of the Nonpoint Source Pollution Control Program*", fulfilling the requirements of Water Code Section 13369 (a)(2)(B). This policy affects landowners and operators throughout the state engaged in agricultural production, timber harvest operations and other potential sources of NPS pollution (Gerstein *et al.* 2005).

The 2004 policy generally expects NPS dischargers to use management practices that do not impair surface water quality and charges each landowner a fee to cover increased regulatory oversight. Consequently, implementation programs for NPS pollution control have expanded beyond waivers and may now be developed by a RWQCB, the SWRCB, individual dischargers or by or for a coalition of dischargers in cooperation with a third-party representative, organization, or government agency. The latter programs are collectively known as "third-party" programs and the third-party role is restricted to entities that are not actual dischargers under RWQCB/SWRCB point-discharge permitting and enforcement jurisdiction. In the Sacramento Valley, an example of a third party would be the Sacramento Valley Water Quality Coalition, a group of more than 7,500 farmers and wetlands managers who are funding surface water data collection with the intention of cooperating to reduce NPS discharges in their watershed[4].

9.1.5.3 LOCAL

YUBA COUNTY GENERAL PLAN

Open Space and Conservation Elements of the Yuba County General Plan (County of Yuba 1996) identify the following goals and objectives specific to water quality and watershed protection:

- The Rice Herbicide Action Plan[5] and other agricultural practices which reduce the threat of surface water pollution from agricultural chemical use shall be supported and encouraged by the county (52-OSCP).

4 www.norcalwater.org/sacvalleycoalition.html

5 The Rice Herbicide Action Plan is a plan developed through the California Department of Agriculture in cooperation with local rice growers and Agricultural Commissioners to control the runoff of toxic pesticides to surface waters when dewatering rice fields.

- Groundwater recharge areas shall be protected from overcovering and contamination through careful regulation of the types of development which occur within these areas (58-OSCP).
- The county shall maintain and apply standards for the control of erosion to development projects and resource production activities (47-OSCP).
- Imposition of runoff controls in conjunction with development projects and resource production which employ best management practices to limit toxics and nutrients entering waterways (13-OSCO).

9.1.5.4 GROUNDWATER QUALITY REGULATORY SETTING

Groundwater regulation is related primarily to water quality issues, which are addressed through a number of different legislative acts and are the responsibility of several different state agencies.

CALIFORNIA WATER CODE

The Water Code states that groundwater should be managed to ensure both its safe production and its quality. Thus, local agencies are to collaboratively study, understand, and manage the safe production, quality and proper storage of groundwater in Water Code Sections 10750 - 10750.10). Groundwater pumping is subject to a number of provisions in the Water Code, and these provisions require compliance with:

- Local groundwater management plans;
- The "no injury" rule; and
- Section 1220 that regulates the direct export of groundwater from the combined Sacramento and Delta-Central Sierra Basins.

As part of these regulations (Water Code Section 10750 et seq.), state well standards and local ordinances govern well placement. The Water Code also requires submission of well completion reports, which must be submitted whenever a driller works on a water well (DWR Website 2007). The installation of new electric powered groundwater wells proposed as part of the Proposed Project/Action would be required to comply with these regulations, as well as other applicable local regulations and ordinances.

GROUNDWATER QUALITY MONITORING ACT OF 2001 (ASSEMBLY BILL 599, WATER CODE SECTION 10780 ET. SEQ)

AB 599, known as the Groundwater Quality Monitoring Act of 2001, set a goal to establish comprehensive groundwater monitoring and increase the availability of information about groundwater quality to the public. The purpose of this act is to highlight those basins in which contamination has occurred, or is likely to occur, and provide information that will allow local managers to develop programs to treat, minimize, or avoid additional contamination. The act also requires the SWRCB, in coordination with other advisory committees, to integrate existing monitoring programs and design a comprehensive statewide groundwater quality monitoring program (State of California Website 2006).

GROUNDWATER MANAGEMENT ACT (ASSEMBLY BILL 3030)

Local groundwater management plans and county ordinances vary by authority, agency and region, but typically involve provisions to limit or prevent groundwater overdraft, regulate transfers, and protect groundwater quality. AB 3030, the Groundwater Management Act, encourages local water agencies to establish local Groundwater Management Plans and lists 12 elements that should be included within the plans to ensure efficient use, good groundwater quality, and safe production of water. The Water Code (Section 10753) identifies these elements as:

- Control of saline water intrusion;
- Identification and management of well head protection areas and recharge areas;
- Regulation of the migration of contaminated groundwater;
- Administration of a well abandonment and destruction program;
- Mitigation of conditions of overdraft;
- Replenishment of groundwater extracted by water producers;
- Monitoring of groundwater levels and storage;
- Facilitation of conjunctive use operations;
- Identification of well construction policies;
- Construction and operation (by the local agency) of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects;
- Development of relationships with state and federal regulatory agencies; and
- Review of land use plans and coordination with land use planning agencies to assess activities that create a reasonable risk of groundwater contamination.

WQCP REQUIREMENTS AND RWQCB AUTHORITIES

As previously discussed for surface water quality, RWQCBs are responsible for the preparation and adoption of Basin Plans, enforcement of the CWA and the Water Code. Each Basin Plan in Sacramento, Yuba and Sutter counties incorporated the maximum contaminant level water quality objectives, as defined in Title 22 of the California Code of Regulations. The Central Valley RWQCB also has a non-degradation policy which states that any new supply of water recharged into the basin must not degrade the existing groundwater basin.

DWR GROUNDWATER MANAGEMENT

DWR manages surface water and groundwater resources throughout the state. As part of these responsibilities, DWR is responsible for preparing Bulletin 118, which periodically is updated to inventory the existing condition of California's groundwater basins. The updated inventories provide information on groundwater basin mapping, new well construction and reporting, and data collection. DWR is responsible for monitoring groundwater levels in approximately 2,000 wells in central California, including portions within the project study area.

LOCAL GROUNDWATER MANAGEMENT AND REGULATION

Local groundwater management plans and county ordinances vary by authority, agency and region, but typically involve provisions to limit or prevent groundwater overdraft, regulate transfers, and protect groundwater quality (also see Chapter 6).

9.2 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES

The Proposed Project/Action and alternatives have the potential to affect surface water quality in reservoirs and rivers in the project study area and the Delta, and the quality of water supplied to downstream CVP and SWP water users.

Changes in reservoir storage and water release patterns caused by the Proposed Project/Action and alternatives potentially could affect reservoir water quality. Similarly, operations changes potentially could affect instream flows in regional river systems. Several different methods were employed to assess the water quality parameters specific to reservoirs and rivers that could be affected by implementation of the Proposed Yuba Accord. The same methodology was used to assess potential water quality effects on the Yuba, lower Feather and Sacramento rivers.

The Proposed Project/Action could provide both stored water and groundwater substitution transfers ranging from 60 TAF per year (to EWA) and up to an additional 140 TAF to the CVP/SWP in drier years, all of which would be conveyed through the Delta. The additional transfer water provided by the Proposed Project/Action could reduce the amount of water the CVP and SWP must dedicate to maintaining SWRCB D-1641 water quality requirements and correspondingly increase the amount of CVP/SWP Project water available for pumping south of the Delta. The increased available CVP/SWP Project water would be exported from the south Delta at the Jones and Banks pumping plants as it becomes available, primarily during the June through September period and to a lesser extent during other months of the year. The water that would be provided by the Proposed Project/Action would be in addition to the 15 TAF which YCWA has previously committed to provide through the SVWMP.

Under the Yuba Accord Alternative, Reclamation and DWR would request a minimum of 60 TAF during almost all water years for the EWA. The EWA account is used by state and federal agencies participating in the CALFED program to repay the CVP and SWP for water lost when the CVP/SWP Projects' export pumping is reduced during periods critical to ESA listed fish species in the Delta. The purpose of the export pumping reductions is to protect and assist in recovery of ESA listed fish species. The EWA Program is currently purchasing water in all years and would likely elect to utilize water from the Yuba Accord Alternative during almost all water years. As discussed in the existing EWA EIS/EIR (Reclamation *et al.* 2003), water purchases under the EWA Program include dedicating a portion of the purchased water to increasing Delta outflow to insure that the increased export pumping of the remaining portion of the purchased water will have no net effect on Delta water quality. Therefore, the hydrological analysis assumes that water from the Yuba Accord Alternative would be requested for the EWA in all years when there is sufficient excess export pumping capacity available to export the additional water acquired as a result of the Yuba Accord Alternative. It is also assumed that a portion of this water would be dedicated to increasing Delta outflow (through carriage water), to insure that water quality in the Delta is not affected, and therefore that maintaining Delta water quality would not result in additional water costs to the CVP/SWP Projects (see Chapter 3).

Regarding the 60 TAF of water proposed for transfer to EWA under the Yuba Accord Alternative, EWA operations, as described in Reclamation (2003), have the potential to affect Delta water quality in years when CVP/SWP pumping is reduced below levels that would have been pumped in the absence of EWA actions, and when the loss of CVP/SWP Project water is repaid in whole or in part by pumping water acquired from water users in the Upstream from the Delta Region through the Delta during the summer months. When EWA acquires water upstream from the Delta to repay or assist in repaying the CVP/SWP for water lost during pumping reductions that water would be provided in the Delta when there is pumping capacity available at the CVP or SWP pumps and would, in most years, be replaced before the end of September. The result would be increased CVP or SWP pumping during the July through September period.

The impact analysis for in-Delta water quality also consists of a detailed qualitative treatment of the use of carriage water (see Section 9.5.1) to maintain Delta water quality standards and avoid potentially significant impacts due to changes in salinity and chloride ion concentrations. In addition to the description in Section 9.5.1, the analysis presented below defines carriage water and evaluates the use of carriage water to protect Delta water quality. For each alternative evaluated in this EIR/EIS, the evaluation also includes a quantitative comparison of the salinity (EC), chloride (mg/l), and organic carbon (mg/l) concentrations occurring under the alternative and the bases of comparison.

To assess the potential impacts that would be expected to occur as a result of implementing one of the alternatives considered for the Proposed Project/Action and alternatives, the discussion presented below addresses the methodology used, presents the impact indicators and significance criteria, and provides an analysis of potential impacts to surface water quality.

9.2.1 IMPACT ASSESSMENT METHODOLOGY

9.2.1.1 ANALYTICAL APPROACH FOR EVALUATING WATER QUALITY CONDITIONS IN RESERVOIRS AND RIVERS

To assess potential reservoir related effects associated with the alternatives considered in this EIR/EIS, the analysis relies on changes in reservoir storage and water surface elevation. When a reservoir is projected to have a higher water surface elevation, there would be an improvement in water quality (greater dilution of constituents of concern). Conversely, when water surface elevations are projected to be lower than under the basis of comparison, it is expected that there would be a potential for impaired water quality (less stratification, warmer water, higher concentrations of pollutants, and greater sediment exposure around the shoreline).

Reservoir storage volumes are an important analytical component for water quality because they provide an indication of dilution factors for constituents of concern. The volume of the coldwater pool also provides an indication of water quality available to coldwater fisheries, and may indirectly provide an indication that there is a sufficient quantity of dissolved oxygen available to support aquatic life and natural benthic processes. In addition, the coldwater pool is often relied upon to ensure the health and protection of downstream riverine fish, particularly for anadromous salmonid spawning and rearing activities.

With regard to aquatic pollution and water quality in the CVP/SWP reservoirs, a greater volume of water present in a particular water body provides a greater amount of dilution of any constituent of concern that may be present in the water. Hence, greater dilution results in a lower concentration of any substance that is present in the water and also results in less stress to aquatic organisms. Metals and other constituents of concern that normally settle out of suspension and concentrate in the sediments most likely would remain within the sediments and would not be disturbed by fluctuations in water surface elevation. Reservoir volumes under each of the Proposed Project/Action and alternatives are compared on relative scale. The difference in simulated average monthly reservoir volume (TAF) is considered to be negligible (i.e., essentially equivalent) if the calculated relative percent difference between the alternative and the basis of comparison is less than one (i.e., 0 percent). Similar to reservoir conditions, the analysis also relies on changes in river flows to determine potential water quality effects that could occur as a result of the project. When river flows are higher, there would be an improvement in water quality (greater dilution of constituents of concern). Conversely, when flows are shown to be lower than under the basis of comparison, it is expected that there would be a potential for impaired water quality (concentration of pollutants, and greater sediment exposure around the shoreline). Water temperature-related changes also are important to consider because such changes may result in direct effects to water quality by changing the concentrations of molecules (e.g., O_2), as well as the rate at which molecular reactions occur between chemical constituents. Temperature also plays a role in how quickly certain physical, chemical and biological reactions occur. For example, the respiration and metabolic rates of most aquatic organisms tend to increase in warmer water. Increased water temperature also can accelerate oxygen demand and bacterial respiration associated with decomposition of organic matter. Water temperature changes and resultant effects on water quality were only quantitatively evaluated in the river reaches downstream of CVP/SWP reservoirs because current modeling simulations cannot predict water temperature variations within the CVP/SWP reservoirs. River reaches upstream of the CVP/SWP reservoirs are independent of reservoir operations and, thus, would not be changed by the Proposed Project/Action or alternatives. However, it was expected that if surface water elevations and storage volumes do not fluctuate beyond the range of normal operating conditions, then reservoir water temperatures also would remain within normal operational ranges.

In addition, the quality of waters distributed for irrigation, particularly for rice cultivation, may be influenced by water temperature. Rice yields are potentially affected by irrigation water temperatures diverted from Daguerre Point Dam. Water temperature is an important factor in the productivity of rice. As a general rule, the productivity of rice increases with rising water temperatures, and below certain temperatures, the plants will not germinate, and those that germinate may not reach productive maturity. Yuba Project operations may potentially affect water temperatures at Daguerre Point Dam where water for agricultural users is diverted from the lower Yuba River. Changes in water temperatures at Daguerre Point Dam could affect water temperatures at the agricultural diversions in the main canal. Warmer water temperatures at the agricultural diversions would be beneficial to agricultural uses, but potentially would conflict with coldwater fisheries management in the lower Yuba River below Daguerre Point Dam (see Chapter 10 for additional information on effects of Daguerre Point Dam water temperatures on aquatic resources).

Because rice plants may be more susceptible to the effects of water temperature during the early phases of development when rice plants transition from growth to reproduction (Mutters *et al.* 2003b), which generally occurs prior to July 31, the analytical time period utilized for assessing potential water temperature-related impacts on agricultural production, represented by changes in rice production, is May 1 through July 31. Water temperature data at Daguerre Point Dam is utilized for this evaluation period.

DISCUSSION OF POTENTIAL WATER QUALITY CONCERNS RELATED TO HARDNESS LEVELS

The RWQCB requested that YCWA, in preparation of the environmental analysis for the 2006 Lower Yuba River Accord Pilot Program (YCWA 2005a), provide information regarding hardness levels of the water bodies potentially affected by the proposed water transfers. The RWQCB had determined that water transfers have the potential to impact water quality when the affected water bodies are of substantially different hardness levels. In particular, if the transfer source water has a lower water hardness level than the receiving water, there is the potential for the transfer to cause a shift (reduction) in hardness levels in the receiving water, thereby causing metals in the water to become more bioavailable than they were previously. The potential for water quality impacts depends upon the dilution potential and on the concentrations of metals in the affected water bodies. The following provides a discussion of the hardness levels in the affected water bodies provided by the RWQCB and an assessment of the potential impacts of the 2006 Lower Yuba River Accord Pilot Program.

The RWQCB indicated that the hardness levels for the Yuba and Feather rivers are generally in the range of 40 mg/l $CaCO_3$. Data for the Feather River for the period of March through November 2002 indicated a low value of 37 mg/l $CaCO_3$ and a high of 40 mg/l $CaCO_3$ (YCWA 2005a). Sacramento River (near Freeport) hardness levels were reported to range from a low of 26 mg/l $CaCO_3$ to a high of 160 mg/l $CaCO_3$ for the period of January 1998 through November 2002 (YCWA 2005a). Hardness levels for the Delta are reported to be in the range of 90 to 100 mg/l $CaCO_3$ (YCWA 2005a). It was determined by the RWQCB that these ranges of hardness levels between the affected water systems would not unreasonably affect water quality or instream beneficial uses for the 2006 Lower Yuba River Accord Pilot Program (YCWA 2005a). This same conclusion applies to the Proposed Project/Action and alternatives.

Additionally, because the Feather and Sacramento river flows are substantially higher than the lower Yuba River flows under Proposed Project/Action and alternatives, there is adequate dilution potential (of Yuba River water) to reduce the possibility of a shift in hardness levels that would result in a water quality concern in any of the receiving water bodies.

CHARACTERIZATION OF MEASURABLE FLOW DETECTION LIMITS

The hydrological models used in the analyses, although mathematically precise, should be viewed as having "reasonable detection limits." Establishing reasonable detection limits is useful to those using the modeling output for impact assessment purposes, and prevents making inferences: (1) beyond the capabilities of the models; and (2) beyond an ability to actually measure changes.

For analytical purposes, *"measurable changes"* have been established and are addressed as part of the impact assessment to account for: (1) detection limits resulting from modeling artifacts (e.g., rounding and simplifying assumptions); and (2) the ability of the monitoring equipment to accurately measure data parameters in the field (e.g., input data accuracy). The establishment of measurable detection limits provides a means of analyzing meaningful differences in simulated flow changes that may occur between the Proposed Project/Action and alternatives, and the bases of comparison at a given location. Measurable changes are further examined in the impact assessment to determine whether these changes are representative of potentially adverse impacts on listed fisheries resources being evaluated.

To establish the percentages of measurable changes in flow, several sources were reviewed. The *Handbook of Hydrology* (Maidment 1993) specifies the following standard to ensure that hydrometeorological information is of sufficient accuracy to meet the objectives of the National Hydrology Reference Network… *"At any one measuring station, 95 percent of all flows estimated from a stage record with a rating shall be within ±8 percent of the actual value."* USGS also provides criteria aimed to determine the accuracy of the data collected. On the *Water Resources Data California Water Year 2002*, USGS states "*…the accuracy of stream flow records depends primarily on (1) the stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements; and (2) the accuracy of measurements of stage and discharge, and interpretation of records. Further, the accuracy attributed to the records is indicated under "REMARKS." "Excellent" means that about 95 percent of the daily discharges are within five percent of the true; "good," within ten percent; and "fair," within 15 percent. Records that do not meet the criteria mentioned are rated "poor." Different accuracies may be attributed to different parts of a given record*."

As discussed above, USGS considers 10 percent to be acceptable or good, and 5 percent to be excellent. The *Handbook of Hydrology* specifies eight percent of the actual value to be the appropriate standard of accuracy. For the flow analyses in this EIR/EIS, the standard used to evaluate measurable changes is more rigorous than the standards discussed above. Two modeled simulations resulting in river flows within one percent of each other at a given location are considered essentially equivalent. Therefore, flow changes occurring between two simulations (e.g., any of the Proposed Project/Action and alternatives and any of the bases of comparison) at a given location must be one percent or greater to be considered a *"measurable"* difference. As a data reduction exercise, mean monthly flow results used in the analyses are limited to actual changes that could be measured (i.e., ≥ 1.0 percent). The reduced data set, which excludes the months in which project-related flows would be essentially equivalent to flows under the bases of comparison, is used to evaluate the months in which project-related changes in flow are greater than one percent, relative to the basis of comparison. Similar applications of modeled output are applied to other output parameters to assure the reasonableness of the impact assessment.

CHARACTERIZATION OF MEASURABLE WATER TEMPERATURE DETECTION LIMITS

The water temperature models used in the analyses, although mathematically precise, should be viewed as having "reasonable detection limits." Establishing reasonable detection limits is useful to those using the modeling output for impact assessment purposes, and prevents making inferences: (1) beyond the capabilities of the models; and (2) beyond an ability to actually measure changes.

For analytical purposes, *"measurable changes"* have been established and are addressed as part of the impact assessment to account for: (1) detection limits resulting from modeling artifacts (e.g., rounding and simplifying assumptions); and (2) the ability of the monitoring equipment to accurately measure data parameters in the field (e.g., input data accuracy). The establishment of measurable detection limits provides a means of analyzing meaningful differences in simulated water temperature changes that may occur between the Proposed Project/Action and alternatives, and the bases of comparison at a given location. Measurable changes are further examined in the impact assessment to determine whether these changes are representative of potentially adverse impacts on listed fisheries resources being evaluated.

Reclamation has developed water temperature models (Reclamation 1997) for all SWP/CVP project rivers based on monthly reservoir water temperatures, hydrologic and climatic data, and the operations during the 72-year simulation period in the CALSIM model (Reclamation Unpublished Work). In-situ temperature loggers were used to collect water temperature data used for the models. These loggers typically have a precision of ±0.36°F, yielding a potential total error of 0.72°F (Deas *et al*. 1997). Therefore, modeled differences in water temperature of 0.36°F or less could not be consistently detected in the river by actual monitoring of water temperatures. In addition, as mentioned above, output from Reclamation's water temperature models provides a "relative index" of water temperatures under the various operational conditions modeled. Output values indicate whether the water temperatures would be expected to increase, remain unchanged, or decrease, and provide insight regarding the relative magnitude of potential changes under one operational condition compared to another.

For the purposes of this impact assessment, modeled water temperature changes that are within 0.3°F between modeled simulations are considered to represent no measurable change (i.e., were considered to be "essentially equivalent"). A level of detection of measurable change of 0.3°F is used because: (1) model output is reported to the one-tenth degree Fahrenheit; (2) rounding the level of error associated with in-situ temperature loggers used for model temperature data up to 0.4°F would eliminate the possibility of detecting measurable change between 0.36°F and 0.4°F; and (3) rounding the level of detection down to 0.3°F is the more rigorous approach in detecting a change in temperature between the modeling results. Temperature differences between modeling results of more than 0.3°F are assessed for their biological significance.

Modeled mean monthly water temperature changes occurring among the Proposed Project/Action and alternatives, and the bases of comparison that are less than or equal to 0.3°F are considered to represent no measurable change (i.e., considered to be "essentially equivalent"). The reduced data set, which excludes the months in which water temperatures under the Proposed Project/Action and alternatives are essentially equivalent to water temperatures under the bases of comparison, is used to evaluate the number of occurrences, as well as the frequency and sequencing of such occurrences, in which measurable water temperature changes under the Proposed Project/Action and alternatives would result in a shift either above or below an applicable temperature indicator value, relative to the bases of comparison.

MEASURABLE CHANGES IN RESERVOIR VOLUME

Reservoir volumes under each of the Proposed Project/Action and alternatives are compared on relative scale. The difference in simulated average monthly reservoir volume (TAF) is considered to be negligible (i.e., essentially equivalent) if the calculated relative percent difference between the alternative and the basis of comparison is equal to or less than one (i.e., 0 percent).

9.2.1.2 *ANALYTICAL APPROACH FOR EVALUATING WATER QUALITY CONDITIONS IN THE DELTA*

To evaluate potential Delta water quality impacts, the analysis relied on quantitative modeling tools to simulate conditions that would be expected to occur under the Proposed Project/Action and alternatives compared to the bases of comparison. The analysis of potential effects to water quality in the Delta includes an analysis of potential effects to water quality for all in-Delta water users. Delta parameters used in the evaluation include simulated changes in X2 location, Delta outflow, E/I ratio, salinity, chloride ion concentrations, DOC concentrations and flows in the Old and Middle rivers. The water quality impact assessment focuses on EC (µS/cm), and chloride ion concentration (mg/l) as indicators of Delta water quality because they are the primary water quality constituents most likely to be affected by temporal shifts in Delta pumping operations. EC also is the parameter for which a considerable amount of monitoring data is available and which has been used to calibrate the modeling tools used to simulate Delta water quality conditions.

CALSIM II has been used to determine Delta parameters that are an index of Delta flow conditions. These include X2 location, Delta outflow, and the E/I ratio. DSM2 has been used to determine EC, chloride and DOC concentrations at specific Delta locations. In addition, DSM2 has been used to quantify net flows in the Old and Middle rivers. Parameters used for the evaluation of Delta water quality are discussed below.

X2 LOCATION

The X2 parameter represents the geographical location of the 2 ppt near-bottom salinity isohaline in the Delta, which is measured in distance upstream from the Golden Gate Bridge in the Suisun Bay (Jassby *et al.* 1995). The location of the estuarine salinity gradient is regulated during the months of February through June by the location of X2 objective in the 1995 WQCP. During this time period, the X2 location must remain downstream of the confluence of the Sacramento and San Joaquin rivers[6] (RK 81, measured upstream from the Golden Gate Bridge) for the entire five-month period. The X2 objective also specifies the number of days each month that that location of X2 must be downstream of Chipps Island (RK 74) or downstream of Roe Island[7] (RK 64).

DELTA OUTFLOW

Freshwater flows provide a barrier against intrusion of saline water from Suisun Bay into the Delta, and are strategically managed through coordinated operations of the CVP/SWP system to meet water quality standards specified in the 1995 WQCP.

Delta outflow objectives established in SWRCB D-1641 extend throughout the year. For the February though June period, Delta outflow objectives are met by compliance with the X2 objective. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. The 1995 Bay-Delta Plan states that "*…Delta outflow objectives are included for the protection of estuarine habitat for anadromous fishes and other estuarine-dependent species*" (SWRCB 1995). Analyses in this document include examination of long-term average monthly changes in Delta outflow, as measured by the Net Delta Outflow Index (NDOI), over the 72-year simulation period, and monthly average changes by water year type for all months of the year under the Proposed Project/Action and alternatives, relative to the bases of comparison.

E/I RATIO

The ratio between CVP/SWP exports and freshwater inflow to the Delta from the Sacramento and San Joaquin river systems (the E/I ratio) is used to assess potential operational impacts on Delta water quality, The E/I ratio is measured as the average 3-day export rate for the SWP Clifton Court Intake and CVP Jones Pumping Plant divided by the average inflow into the Delta over a 3 to 14 day period. E/I standards specified in D-1641 are presented in **Table 9-15**. D-1641 standards for the E/I ratio specify maximum ratios of 35 percent from February to June and 65 percent during all other months. The framework for environmental analyses has

[6] Also referred to as Collinsville.

[7] Also referred to as the Port Chicago EC monitoring station.

typically assumed that higher export rates relative to freshwater inflow, on a seasonal basis, would increase the probability of adverse impacts to beneficial uses as a result of CVP and SWP export operations.

The Delta E/I ratio limits are built into the CALSIM modeling assumptions and, therefore, are consistently met under the Proposed Project/Action and alternatives during all months of the year.

Table 9-15. Delta Export/Inflow Ratio Limits

Time Period	Export/Inflow Ratio Limits
October - January	≤ 65 percent
February	35 percent (If January 8RI[8] ≥ 1.5 MAF) 35 percent-45 percent (If January 8RI is between 1.0 and 1.5 MAF 45 percent (If January 8RI ≤ 1.0 MAF)
March	≤ 35 percent
April 15 - May 16	≤ 35 percent
May 16 - June	≤ 35 percent
July - September	≤ 65 percent

SALINITY

Salinity-related water quality impacts associated with the operational component of the Project alternatives were assessed at several locations in the Delta. EC is used as a surrogate for salinity. Using the assumptions discussed above and detailed in Appendix D, the DSM2 model calculated changes in monthly mean EC[9] values for the Proposed Project/Action and alternatives, relative to the bases of comparison. The monthly EC results were derived for a 16-year simulation period, extending from 1976 through 1991.

The DSM2 model provides output for the following established regional Delta compliance points:

- Sacramento River at Emmaton
- San Joaquin River at Jersey Point
- San Joaquin River at Brandt Bridge
- Middle River at Old River
- Old River at Tracy Road Bridge
- Old River at Highway 4 (CCWD Los Vaqueros Intake)
- West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant)
- Delta-Mendota Canal at Jones Pumping Plant (CVP Jones Pumping Plant)
- CCWD Pumping Plant #1 (Rock Slough)
- Middle River at Victoria Canal near the proposed CCWD intake

8 The term "8RI" refers to the eight river index which is the sum of the unimpaired forecast for: (1) Sacramento River at Bend Bridge; (2) Feather River at Oroville Reservoir; (3) Yuba River at Smartville; (4) American River at Folsom Lake; (5) Stanislaus River at New Melones Reservoir; (6) Tuolumne River at Don Pedro Reservoir; (7) Merced River at Exchequer Reservoir; and (8) San Joaquin River at Millerton Lake.

9 EC is generally considered a conservative parameter, not subject to sources of losses internal to a water body. Therefore, changes in EC values can be used to interpret the movement of water and the mixing of salt in the Delta (Reclamation and DWR 2005).

- Proposed City of Stockton Delta intake on the San Joaquin River at Empire Tract

The following DSM2 model output is used to evaluate potential changes in salinity under the Proposed Project/Action and alternatives, relative to the basis of comparison:

- The number of simulated changes equal to or greater than 10 percent in monthly mean EC values;
- The number of changes equal to or greater than five percent in long-term monthly average EC values and average monthly EC values by water year type; and
- The number of occurrences during which an EC compliance standard is met or exceeded.

Changes in salinity are evaluated in the Delta during months of increased pumping under the Proposed Project/Action and alternatives, relative to the basis of comparison. Potential significant impacts could occur if salinity increases are of sufficient frequency and magnitude over the long-term to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality.

CHLORIDES

Changes in the monthly pumping pattern under the Proposed Project/Action and alternatives has the potential to result in water of higher chloride concentrations being delivered to CCWD, CVP and SWP water users south of the Delta during months of increased pumping, resulting in more total salts being delivered to these water users (Reclamation 2006). This analysis includes a quantitative evaluation of DSM2 model output for several locations for which there exist D-1641 compliance standards for which potential increases in chloride ion concentration could potentially impact designated beneficial uses. Long-term average total monthly chloride concentration (mg/l) and average monthly chloride concentration by water year type were evaluated in order to determine if potential changes in the monthly pumping patterns would result in increases in the average monthly chloride concentration of water delivered to CVP/SWP water users in south of the Delta under the Proposed Project/Action and alternatives. Chloride concentrations were evaluated at the following locations:

- Old River at Highway 4 (CCWD Los Vaqueros)
- CCWD Pumping Plant #1
- Old River at Rock Slough (CCWD Intake)
- West Canal at the mouth of Clifton Court Forebay
- Delta-Mendota Canal at the Jones Pumping Plant
- Middle River at the Victoria Canal
- Proposed City of Stockton Delta intake

The following DSM2 model output is used to evaluate Delta water quality under the Proposed Project/Action and alternatives, relative to the basis of comparison:

- The number of simulated changes equal to or greater than 10 percent in monthly mean chloride concentrations;

- The number of changes equal to or greater than five percent in long-term monthly average chloride concentrations and average monthly chloride concentrations by water year type; and
- The number of occurrences during which a chloride concentration compliance standard is met or exceeded.

DISSOLVED ORGANIC CARBON

Organic carbon was analyzed separately because its seasonal distribution pattern varies from that of EC and chloride ion concentration. Simulated effects of Proposed Project/Action and alternatives on DOC concentrations depend on estimated inflow concentrations and inflow source contributions, and on the assumed sources of DOC from Delta agricultural drainage. DWR has collected water samples from numerous Delta channels, agricultural drainages, and export locations. These measurements have been used to estimate changes in DOC between Delta inflows and Delta export locations. DSM2 simulations were used to estimate changes in EC and DOC at the CVP, SWP and CCWD export locations for the 16-year simulation period, extending from 1975 through 1991.

Agricultural diversions are not affected by DOC concentrations (Reclamation and DWR 2005) and, thus, the DOC analysis focused on locations proximate to the following water supply intake structures, including: (1) Old River at Highway 4 (CCWD Los Vaqueros Intake); (2) Old River at Bacon Island (CCWD Intake at Rock Slough); (3) West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant); and (4) Delta-Mendota Canal at Jones Pumping Plant (CVP Jones Pumping Plant). The DOC estimates also are considered in relation to bromide concentrations at the same location to evaluate the potential for THM formation.

(CCWD and Reclamation 2006)A detailed description of the hydrologic modeling assumptions and methodology used in the analysis is provided in Chapter 4, and model template output supporting the operations-related analyses is presented in Appendix D.

SOUTH DELTA FLOWS

During periods of low Delta outflow, saltwater intrusion (tidal mixing) from Suisun Bay enters the Delta and is transported from the vicinity of Franks Tract towards the CCWD intakes and the CVP and SWP pumping plants. Under these conditions, the quality of agricultural water supplies in the western Delta also can be affected by seawater intrusion during the irrigation season. Old and Middle rivers [10] are two of the major connections into the south Delta channels, and are pathways for export water moving toward the CVP and SWP pumps in the south Delta. Net flows in Old and Middle rivers are dependent on San Joaquin River flows at Vernalis and the total combined exports at the Banks and Jones pumping plants. Because exports tend to draw water from the north Delta, this can produce net negative flows and increase salinity in Old and Middle rivers as water moves toward the CVP and SWP pumping facilities in the south Delta.

The Middle River channel extends north from Victoria Canal along the eastern edge of Victoria Island, Woodward Island and Bacon Island. The Middle River channels north of Victoria Island

[10] The Middle River channel extends north from Victoria Canal along the eastern edge of Victoria Island, Woodward Island and Bacon Island. The Middle River channel reaches north of Victoria Island and is also hydraulically connected to the Old River. About half of the water moving through the Delta from the Sacramento River flows down the Middle River to Victoria Canal toward CVP/SWP pumping facilities.

are also hydraulically connected to the Old River. About half of the water moving through the Delta from the Sacramento River flows down the Middle River to Victoria Canal toward CVP/SWP pumping facilities. In general, exports tend to draw water from the north Delta producing net negative flows that move towards south Delta pumping facilities.

Federal and state agencies have developed a number of potential habitat and fish protection actions, including limits on Old River and Middle River flows, seasonally decreased Delta outflows, and additional export restrictions. Based on 2006/2007 Interagency Ecological Program (IEP) and Pelagic Organism Decline (POD) investigations, potential actions include minimizing the net upstream (negative) flow in the Old and Middle rivers from January to February to between 3,500 cfs and 5,000 cfs (DWR and CDFG 2007). Potential changes in Delta export pumping operations are further discussed in Section 10.1.4.1.

The magnitude and direction of flows at various locations are used as an indicator of the hydraulic conditions in the south Delta resulting from changes in Delta pumping operations under the Proposed Project/Action and alternatives. These flows are reported as a measure of the potential impact that future IEP/POD actions could have on CVP/SWP operations. However, the decision to implement POD actions will be made on a real-time basis, and thus flows outlined in the POD Action Plan cannot be used as significance criteria to evaluate the Proposed Project/Action and alternatives. This analysis is presented to illustrate how Delta pumping operations under the Proposed Project/Actions and alternatives may potentially influence future POD Action Plan decisions.

The hydrodynamic influence of CVP/SWP exports influencing the magnitude and direction of flows in the south Delta under the Proposed Project/Action, relative to the basis of comparison, is evaluated at the following locations: (1) Old River at Bacon Island; (2) Middle River at Middle River; and (3) Middle River at Mowry Bridge.

9.2.1.3 Analytical Approach for Evaluating Changes in Groundwater Quality

The Proposed Project/Action would involve groundwater pumping, which potentially could alter the existing subsurface hydrology and, thus, result in a variety of potential changes in the following:

- Groundwater levels
- Existing hydrologic interactions between surface water and groundwater
- Land subsidence
- Degradation of groundwater quality

Changes in Groundwater Levels: Changes in groundwater levels could cause multiple secondary impacts. Declining groundwater levels could result in: (1) increased groundwater pumping cost due to increased pumping depth; (2) decreased yield from groundwater wells due to reduction in the saturated thickness of the aquifer; (3) reduced groundwater in storage; and (4) decrease of the groundwater table to a level below the vegetative root zone, which could result in environmental impacts. Potential impacts related to groundwater level changes are evaluated in Chapter 6.

Surface Water and Groundwater Interactions: Groundwater pumping within the vicinity of a surface water body could change the existing interactions between surface and groundwater, potentially resulting in decreased stream flows and levels, with potential adverse impacts to riparian habitats and downstream users. The pumping of groundwater near wetland habitats could also result in adverse environmental impacts. Potential impacts related to surface water and groundwater interactions are evaluated in Chapter 6.

Land Subsidence: Excessive groundwater extraction from confined and unconfined aquifers could result in a lowering of groundwater levels and, in confined aquifers, a decline in water pressure. The reduction in water pressure results in a loss of support for clay and silt beds, which subsequently compress, and cause a lowering of the ground surface (land subsidence). The compaction of fine-grained deposits, such as clay and silt, is permanent. The possible consequences of land subsidence may include (1) infrastructure damage; and (2) alteration of drainage patterns. Potential impacts related to land subsidence are evaluated in Chapter 6.

Groundwater Quality: Changes in groundwater levels or in the prevailing groundwater flow regime could cause a change in groundwater quality through a number of mechanisms. One mechanism is the potential mobilization of areas of poorer quality water, drawn down from shallow zones, or drawn up into previously unaffected areas. Changes in groundwater gradients and flow directions could also cause (or speed) the lateral migration of poorer quality water. Artificial or enhanced recharge of the aquifer with water of poorer quality, or even different geochemical constituents, could also have an adverse effect on existing conditions. Geochemical differences between the recharged water and groundwater could affect resultant groundwater quality through geochemical processes such as precipitation, bacterial activity, ion exchange, and adsorption. Potential groundwater quality impacts are evaluated in Chapter 6 to determine whether increases in annual groundwater pumping would be anticipated to impair the quality of the local groundwater aquifer, or lead to increased difficulties in the ability of local water purveyors to meet specified regulatory standards for M&I deliveries, as required by CDHS.

9.2.2 IMPACT INDICATORS AND SIGNIFICANCE CRITERIA FOR WATER QUALITY

Thresholds of significance were developed to assess the potential impacts of the Proposed Project/Action and alternatives on surface water quality within the project study area (**Table 9-16**). These thresholds of significance are consistent with CEQA Guidelines Section 15065(a) (CELSOC 2005).

The Proposed Project/Action and alternatives evaluated in this EIS/EIR, relative to the basis of comparison, would result in significant water quality impacts if:

- Existing adopted water quality standards would be violated;
- Beneficial uses of water would be substantially adversely affected;
- Substantive undesirable effects on public health or environmental receptors would occur; and
- Water quality conditions would be otherwise degraded.

9.2.2.1 ADDITIONAL CONSIDERATIONS REGARDING DELTA IMPACT INDICATORS

The impact significance criteria for Delta water quality variables that have regulatory objectives or numerical standards, such as those contained in the 1995 WQCP, are developed from the general considerations listed below.

Table 9-16 Impact Indicators and Significance Criteria for Surface Water Quality

Impact Indicator	Significance Criteria
Yuba Region	
New Bullards Bar Reservoir	
End-of-month reservoir storage (TAF) occurring for each month of the year.	Decrease in reservoir storage (TAF), relative to the basis of comparison, of sufficient frequency and magnitude over the long-term, to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality for any month of the year over the 72-year simulation period.
Lower Yuba River	
Monthly mean flows (cfs) occurring at Marysville and Smartville for each month of the year.	Decrease in flow, relative to the basis of comparison, of sufficient frequency and magnitude over the long-term, to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality for any month of the year over the simulation period.
Monthly mean water temperatures (°F) at Marysville and Smartville for each month of the year.	Increase in water temperature, relative to the basis of comparison, of sufficient frequency and magnitude over the long-term, to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality for any month of the year over the simulation period.
Monthly mean water temperature (°F) at Daguerre Point Dam.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect agricultural production, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value of 65°F is used as evaluation guideline to determine whether agricultural production has been substantially affected.
CVP/SWP Upstream of the Delta Region	
Oroville Reservoir	
End-of-month reservoir storage (TAF) for each month of the year.	Decrease in reservoir storage, relative to the basis of comparison, relative to the basis of comparison, of sufficient frequency and magnitude over the long-term, to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality for any month of the year over the 72-year simulation period.
Lower Feather River	
Monthly mean flow (cfs) below the Fish Barrier Dam, below the Thermalito Afterbay Outlet and at the mouth of the Feather River for each month of the year.	Decrease in flow, relative to the basis of comparison, of sufficient frequency and magnitude over the long-term, to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality for any month of the year over the 72-year simulation period.
Monthly mean water temperature (°F) below the Thermalito Afterbay Outlet and at the mouth of the Feather River for each month of the year.	Increase in water temperature, relative to the basis of comparison, of sufficient frequency and magnitude over the long-term, to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality for any month of the year over the 72-year simulation period.
Lower Sacramento River	
Monthly mean flow (cfs) at Freeport for each month of the year.	Decrease in flow, relative to the basis of comparison, of sufficient frequency and magnitude over the long-term, to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality for any month of the year over the 72-year simulation period.
Monthly mean water temperatures (°F) at Freeport for each month of the year.	Increase in water temperature, relative to the basis of comparison, of sufficient frequency and magnitude over the long-term, to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality for any month of the year over the 72-year simulation period.

Table 9-16 (continued)

Impact Indicator	Significance Criteria
Delta Region	
Sacramento-San Joaquin Delta	
Monthly mean location of X2 for all months of the year.	Change in the position of X2, relative to the basis of comparison, of sufficient frequency and magnitude to adversely affect water quality over the 72-year simulation period.
Monthly mean Delta export/inflow (E/I) ratios for all months of the year.	Change in the Delta E/I ratio, relative to the basis of comparison, of sufficient frequency and magnitude to adversely affect water quality over the 72-year simulation period.
Salinity, chlorides, and DOC concentrations within the Delta during any month of the year.	Changes in salinity, chlorides and DOC concentrations within the Delta during months of increased pumping resulting in an increase in salinity, chlorides or DOC concentrations, relative to the basis of comparison, of sufficient frequency and magnitude over the long-term, to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality.
Export Service Area	
San Luis Reservoir	
End-of-month reservoir storage (TAF) for each month of the year.	Decrease in reservoir storage, relative to the basis of comparison, of sufficient frequency and magnitude over the long-term, to adversely affect designated beneficial uses, to exceed existing regulatory standards or to substantially degrade water quality for any month of the year over the 72-year simulation period.

- Numerical water quality objectives have been established to protect beneficial uses, and therefore represent concentrations or values that should not be exceeded.
- Natural variability caused by tidal flows, river inflows, agricultural drainage, and biological processes in the Delta channels is sometimes large relative to the numerical standards or mean values of water quality variables.
- Changes in water quality variables that are greater than natural variations, but are within the limits established by numerical water quality objectives, may cause significant impacts; a criterion for determining significant monthly changes is necessary.
- Monthly changes in a water quality variable that are greater than natural variations, but which occur infrequently enough such that the long-term average value is not raised by more than a specified percentage of the baseline value are considered to be less than significant; a criterion for determining significant long-term changes is necessary.

For variables with numerical water quality criteria, the numerical limits are assumed to adequately protect beneficial uses and provide the basic measure of an allowable limit that will adequately protect beneficial uses. An increase in the variable under the Proposed Project/Action and alternatives, relative to the bases of comparison that cause the variable to exceed the numerical objective is considered to be a significant impact. Variables without numerical limits would not have a maximum significance criterion.

Natural variability is difficult to describe with a single value, but it is assumed that 10 percent of the specified numerical criterion (for variables with numerical criteria) or 10 percent of the mean value (for variables without numerical criteria) would be a reasonable representation of natural variability that would be expected to occur without causing a significant impact (Reclamation and DWR 2005). Simulated monthly changes that are less than 10 percent of the numerical criterion or less than 10 percent of the measured or simulated mean value of the variable would not be considered significant water quality impacts because the simulated change would not be greater than natural variability.

A monthly significance criterion is based on the assumption that some changes may be substantial in comparison with natural variability of the water quality variable, and could result in significant impacts. Because the change in water quality that should be considered substantial is not known, judgment must be applied to establish an appropriate significance threshold. Based on the measured range of natural variability, the monthly significance criterion has been selected to be 10 percent of the numerical limits (for variables with numerical limits). It is assumed that this 10 percent change criterion would prevent relatively large changes that may have potentially significant impacts on beneficial uses. For variable without a numerical limit (e.g., DOC), a monthly change criterion of 10 percent of the mean value is used as the criterion (Reclamation and DWR 2005).

The Draft SDIP EIS/EIR (Reclamation and DWR 2005) recognized that an allowable long-term average increase in a water quality parameter that is less than significant also is difficult to determine from purely scientific evidence. The maximum allowable value has been determined by a regulatory agency to protect the beneficial uses that are dependent on the water quality parameter. Therefore, it is generally assumed in the Draft SDIP EIS/EIR that raising the average value by some small percentage would not cause significant harm to the protected beneficial uses (Reclamation and DWR 2005). Based on the rationale provided in the Draft SDIP EIS/EIR, a change (increase) in long-term average salinity levels of 5 percent or more was selected as the criterion for determining whether potential Delta water quality impacts would be expected to occur under the Proposed Project/Action and alternatives, relative to the basis of comparison. Although there may be some significant changes on an individual monthly basis, the overall impact on salinity or DOC was considered less than significant if the long-term increase remained less than 5 percent of the baseline average salinity or DOC concentrations.

SALINITY

Delta water quality is directly controlled by existing Delta water quality objectives (1995 WQCP) for municipal and industrial, agricultural, and fish and wildlife uses that are incorporated into D-1641. The 1995 WQCP objectives vary with month and water year type. Also, the 1995 WQCP objectives may only apply for some months and at some locations.

ELECTRICAL CONDUCTIVITY

Applicable EC objectives are specified for the agricultural diversion season of April through August at Emmaton and Jersey Point, and during the entire year at each of the CVP/SWP export locations, and three south Delta locations. Significance criteria for EC may therefore be different for each month at each Delta location.

Increases in EC values that result in exceedance of the maximum objective at specified locations in the Delta are considered to be significant water quality impacts. Monthly changes in EC values are also considered to be significant if they exceed 10 percent of the applicable objective.

The 1995 WQCP agricultural objectives for EC, ranging from 450 µS/cm to 2,200 µS/cm, are applicable at Jersey Point from April through August 15. Similar EC objectives are applicable at Emmaton. At Emmaton and Jersey Point, the threshold of 10 percent change is equivalent to an allowable increase of 45 µS/cm when the 450 µS/cm EC objective is applicable.

The EC objective for the export locations is 1,000 µS/cm for all months, expressed as a maximum monthly average of mean daily values. Three south Delta locations have 30-day moving average EC objectives of 1,000 µS/cm. The threshold of a 10 percent change is equivalent to an allowable increase of 100 μS/cm at the Delta export locations and at the three south Delta locations.

X2

Estuarine EC objectives (i.e., X2) specified in the 1995 WQCP are applicable at Chipps Island during February through June of most years. The maximum EC objective at Chipps Island is 2,640 μS/cm (corresponding to a 2-ppt salinity at Chipps Island) and must be satisfied for a specified number of days each month, depending on the previous month's Eight River Index (a measure of runoff in the Sacramento and San Joaquin valleys). For Chipps Island, the threshold of 10 percent change is equivalent to an allowable increase of 264 μS/cm when the 2,640 μS/cm estuarine objective is applicable (as long as the X2 objective is not exceeded).

CHLORIDE CONCENTRATION

The 1995 WQCP specifies an objective of 250 mg/l chloride concentration at M&I intake locations (CCWD Pumping Plant #1, West Canal at mouth of Clifton Court Forebay, Delta-Mendota Canal at Jones Pumping Plant, Barker Slough at North Bay Aqueduct Intake, and Cache Slough at City of Vallejo Intake). The CCWD at Rock Slough chloride is also subject to a 150 mg/l objective for about half of each calendar year (5 months in critical year, 8 months in wet years). Both the 250 mg/l and the 150 mg/l chloride objective are considered in CALSIM II, and the necessary Delta outflow to meet this chloride objective is calculated within the model. Therefore, both Rock Slough chloride objectives are assumed to be satisfied with the simulated Delta outflow values from the CALSIM model.

DISSOLVED ORGANIC CARBON

DOC concentrations in the Delta exhibit relatively large fluctuations(Reclamation and DWR 2005). Although no numerical water quality objectives have been developed for DOC concentrations, criteria for DOC can be determined from average data on Delta DOC and the estimated effects of DOC concentrations on THM concentrations in treated drinking water. Increases in monthly export DOC of more than 10 percent of the mean DOC concentration (assumed to be about 4 mg/l), or about 0.4 mg/l, are considered to be significant water quality impacts (Reclamation and DWR 2005). Because THM standards involve annual average criteria, the significance criterion for the estimated long-term increase in export DOC concentrations should apply. The average DOC concentrations in the exports should be limited to a change that is small enough to prevent a change in long-term THM concentration of more than 8 μg/l (because 8 μg/l is 10 percent of the current THM standard of 80 μg/l).

A general correlation between DOC concentration and THM concentration suggests that about 10 to 20 μg/l of THM will result from each 1 mg/l of DOC in the raw water supply (State Water Resources Control Board 1995b). Therefore limiting the long-term DOC increases to about 0.4 mg/l would also likely limit the increase in long-term THM to less than 8 μg/l. Simulation of THM concentrations in treated water obtained from the Delta was not part of the impact evaluation because the simulated changes in EC and DOC can be used as surrogates for the potential effects on THM and other disinfection by-products at specific treatment plants using Delta water.

As discussed in Chapter 4, CEQA and NEPA have different legal and regulatory standards that require slightly different assumptions in the modeling runs used to compare the Proposed Project/Action and alternatives to the appropriate CEQA and NEPA bases of comparison in the impact assessments. Although only one project (the Yuba Accord Alternative) and one action alternative (the Modified Flow Alternative) are evaluated in this EIR/EIS, it is necessary to use separate NEPA and CEQA modeling scenarios for the Proposed Project/Action, alternatives and bases of comparisons to make the appropriate comparisons. As a result, the scenarios compared in the impact assessments below have either a "CEQA" or a "NEPA" prefix before the name of the alternative being evaluated. A detailed discussion of the different assumptions used for the CEQA and NEPA scenarios is included in Appendix D, Modeling Technical Memorandum.

As also discussed in Chapter 4, while the CEQA and NEPA analyses in this EIR/EIS refer to "potentially significant," "less than significant," "no" and "beneficial" impacts, the first two comparisons (CEQA Yuba Accord Alternative compared to the CEQA No Project Alternative and CEQA Modified Flow Alternative compared to the CEQA No Project Alternative) presented below instead refer to whether or not the proposed change would "unreasonably affect" the evaluated parameter. This is because these first two comparisons are made to determine whether the action alternative would satisfy the requirement of Water Code Section 1736 that the proposed change associated with the action alternative "would not unreasonably affect fish, wildlife, or other instream beneficial uses."

9.2.3 Environmental Impacts/Environmental Consequences of the CEQA Yuba Accord Alternative Compared to the CEQA No Project Alternative

Impact 9.2.3-1: Decreases in New Bullards Bar Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year simulation period, differences in long-term average end-of-month storage under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would not exceed 8 percent (Appendix F4, 3 vs. 2, pg. 1). During months when reservoir storage volumes are typically lowest[11], average differences in monthly storage range from 6 percent lower in August to 8 percent lower in October and November under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative. Differences during all other months would not exceed 6 percent. Differences in average end-of-month storage by water year type are up to 9 percent lower during some months. During periods exhibiting the lowest reservoir storage conditions occurring in October and November, which include some of the lowest monthly storage conditions on record for New Bullards Bar Reservoir (i.e., lowest 25 percent of the cumulative probability distribution), storage would be on average about 10 percent lower 90 percent of the time (Appendix F4, 3 vs. 2, pg. 26 through 37) under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative.

Generally, a greater volume of water present in the reservoir equates to a greater amount of dilution regarding any constituent of concern that may be present in the water. However, the magnitude and frequency of the changes (i.e., up to 10 percent lower 25 percent of the time during October and November) in reservoir storage levels simulated under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not be likely to cause metals and other constituents of concern that may be concentrated in the sediments at the bottom of the reservoir to be re-suspended and degrade long-term water quality. In addition, decreases in water quality in New Bullards Bar due to increases in water temperature are

[11] Generally ranging from August through November.

unlikely to occur due to its steep-sided conical shape, which creates sufficient water depths to maintain a large cold pool reservoir under all operational reservoir levels throughout the year.

As a result of the water transfers occurring from July through September under the CEQA Yuba Accord Alternative, large reductions in New Bullards Bar Reservoir storage would be expected to occur during the late summer and fall. However, the frequency and magnitude of these reductions in storage would not be sufficient to reduce the long-term water quality in New Bullards Bar Reservoir due to the morphology of the reservoir. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect water quality in New Bullards Bar Reservoir.

Impact 9.2.3-2: Changes in monthly mean flows in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

During the seasonal high flow period (i.e., December through June), long-term average flows in the lower Yuba River at Smartville would range from essentially equivalent in April and June to approximately 9 percent lower in December under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative over the 72-year simulation period (Appendix F4, 3 vs. 2, pg. 100). During the seasonal low flow period[12], long-term average flows in the lower Yuba River at Smartville range from approximately 25 percent higher in August to approximately 3 percent lower in November under the CEQA Yuba Accord Alternative. During typically low flow conditions[13] occurring from August through November, flows would be on average about 15 percent to 35 percent higher about 90 percent to 100 percent of the time (Appendix F4, 3 vs. 2, pg. 125 through 136) under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative.

During the seasonal high flow period[14], long-term average flows in the lower Yuba River at Marysville range from essentially equivalent in April, approximately 1 percent higher in June, and approximately 9 percent lower in December under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pg. 272). During the seasonal low flow period[15], long-term average flows in the lower Yuba River at Marysville would range from approximately 56 percent higher in August to approximately 3 percent lower in November under the CEQA Yuba Accord Alternative. During typically low flow conditions[14] from August through November, flows under the CEQA Yuba Accord Alternative would be on average about 20 percent to 80 percent higher about 90 percent to 100 percent of the time (Appendix F4, 3 vs. 2, pg. 297 through 308) under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative.

Overall, lower Yuba River flows under the CEQA Yuba Accord Alternative would be higher than flows under the CEQA No Project Alternative. Increased lower Yuba River flows would allow dilution of water quality constituents, including pesticides and fertilizers from agricultural runoff, potentially having a beneficial effect on water quality. Changes in the frequency and magnitude of flows in the lower Yuba River would not result in any long-term impacts to designated beneficial uses, existing regulatory standards, degradation of general water quality. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect water quality in the lower Yuba River.

[12] Generally ranging from August through November in the lower Yuba River.

[13] The lowest 25 percent of the monthly cumulative probability distribution.

[14] Generally ranging from December through June in the lower Yuba River.

Impact 9.2.3-3: Changes in monthly mean water temperatures in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average water temperatures in the lower Yuba River at Smartville under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative would be essentially equivalent[15] during all months (Appendix F4, 3 vs. 2, pg. 174). Long-term average water temperatures at Marysville would be essentially equivalent during most months with the exception of May when water temperatures would be 0.4ºF higher, and the July through October period when they would be up to 2.0ºF lower under the CEQA Yuba Accord Alternative (Appendix F4, 3 vs. 2, pg. 346). In addition, long-term average monthly water temperatures and average monthly water temperatures by water year in the lower Yuba River would not exceed 65ºF under the CEQA Yuba Accord Alternative.

Under the CEQA Yuba Accord Alternative, long-term average water temperatures at Daguerre Point Dam during the April through July period would be essentially equivalent during most months with the exception of July, when they would be 0.4ºF higher compared those under the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pg. 223). Surface water is diverted from Daguerre Point Dam to irrigate rice fields from May through July (see Section 9.2.1.1). The average water temperatures during these times would not exceed about 58ºF under either alternative. For all water years, average monthly water temperatures at Daguerre Point Dam would be essentially equivalent to the CEQA No Project Alternative and generally remain below 60ºF. There would be no occurrences under either the CEQA Yuba Accord Alternative, or the CEQA No Project Alternative during which monthly mean water temperatures exceed 65ºF (Appendix F4, 3 vs. 2, pg. 224 through 235).

Overall, lower Yuba River water temperatures under the CEQA Yuba Accord Alternative would be similar to those under the CEQA No Project Alternative. Water temperature changes occurring in the lower Yuba River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, would not unreasonably affect water quality in the lower Yuba River.

Impact 9.2.3-4: Decreases in Oroville Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average end-of-month Oroville Reservoir storage and average monthly storage by water year type would be essentially equivalent under the CEQA Yuba Accord Alternative, and CEQA No Project Alternative (Appendix F4, 3 vs. 2, pg. 406). During all months, the cumulative reservoir storage distributions would be essentially equivalent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative over 90 percent of the time, with the exception of June when reservoir storage would be higher approximately 10 percent of the time, and essentially equivalent 90 percent of the time (Appendix F4, 3 vs. 2, pg. 431 through 442). Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative would not unreasonably affect water quality in Oroville Reservoir.

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[15] Essentially equivalent refers to water temperature differences between the alternative and the basis of comparison that are less than 0.3 ºF (see Section 9.2.1).

Impact 9.2.3-5: Changes in monthly mean flows in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly flows or average monthly flows by water year type in the Feather River below the Fish Barrier Dam under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pg. 505).

Long-term average monthly flows in the Feather River below the Thermalito Afterbay Outlet would be 5 percent lower in June and 2 percent lower in September under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, and essentially equivalent[16] or up to about 3 percent higher during all other months (Appendix F4, 3 vs. 2, pg. 603). Long-term average monthly flows in the Feather River at the mouth under the CEQA Yuba Accord Alternative would be up to approximately 8 percent higher from July through October and essentially equivalent to approximately 3 percent lower from November through June (Appendix F4, 3 vs. 2, pg. 775). Decreases in average monthly flow below the Thermalito Afterbay Outlet and at the mouth of the Feather River would range from 1 percent lower to approximately 17 percent lower during all water years. In addition, during July, August, September, and October of critical water years, flows would be up to 12 percent higher under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative.

During low flow conditions occurring from September through November, below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be essentially equivalent about 60 to 85 percent of the time, and higher about 40 percent to 15 percent of the time (Appendix F4, 3 vs. 2, pg. 628 through 639). During low flow conditions (i.e., lowest 25 percent of the monthly cumulative probability distribution) at the mouth of the Feather River occurring from September through November, flows under the CEQA Yuba Accord Alternative are essentially equivalent about 15 to 45 percent of the time, and higher about 85 percent to 55 percent of the time (Appendix F4, 3 vs. 2, pg. 800 through 811).

Overall, lower Feather River flows under the CEQA Yuba Accord Alternative would not substantially change compared to the CEQA No Project Alternative and, thus, would not be expected to degrade water quality or adversely affect beneficial uses. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, would not unreasonably affect water quality in the lower Feather River.

Impact 9.2.3-6: Changes in monthly mean water temperatures in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly water temperatures or average monthly water temperatures by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative below the Fish Barrier Dam (Appendix F4, 3 vs. 2, pg. 554).

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type in the lower Feather River below the Thermalito Afterbay Outlet (Appendix F4, 3 vs. 2, pg. 677) and at the mouth (Appendix F4, 3 vs. 2, pg. 824) under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would be essentially equivalent with the exception of June and July of above normal water years when they would be 0.4ºF higher and 0.3ºF lower below the Thermalito Afterbay Outlet. Water temperatures below the Thermalito Afterbay Outlet would be essentially equivalent during all months under the CEQA Yuba Accord Alternative, relative to the CEQA

[16] Differences in flow less than or equal to 1 percent are considered essentially equivalent (see Section 9.2.1).

No Project Alternative, 90 percent to 100 percent of the time over the cumulative water temperature distribution (Appendix F4, 3 vs. 2, pg. 707 through 713). At the mouth of the Feather River, water temperatures would be essentially equivalent about 95 percent to 100 percent of the time during all months of the cumulative water temperature distribution with the exception of May and July (Appendix F4, 3 vs. 2, pg. 849 through 860). During May water temperatures would be essentially equivalent about 60 percent of the time and higher up to 0.8ºF about 40 percent of the time. During the highest 25 percent of the cumulative water temperature distribution (i.e., highest 25 percent of water temperatures), water temperatures in May would be on average 0.5ºF higher about 40 percent of the time and slightly lower or essentially equivalent for the remainder of the distribution. During July, water temperatures under the CEQA Yuba Accord Alternative would be essentially equivalent about 15 percent of the time and slightly lower 85 percent of the time over the cumulative water temperature distribution, relative to the CEQA No Project Alternative.

Overall, lower Feather River water temperatures under the CEQA Yuba Accord Alternative would be similar to those under the CEQA Existing Condition. Water temperature changes occurring in the lower Feather River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, would not unreasonably affect water quality in the lower Feather River.

Impact 9.2.3-7: Changes in monthly mean flows in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Sacramento River below the confluence of the Feather River under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would be approximately 1 percent lower in December and June, and essentially equivalent or up to about 3 percent higher during all other months (Appendix F4, 3 vs. 2, pg. 882). Long-term average monthly flows in the Sacramento River at Freeport under the CEQA Yuba Accord Alternative would be up to approximately 3 percent higher from July to October and essentially equivalent to approximately 1 percent lower during all other months (Appendix F4, 3 vs. 2, pg. 1005). Decreases in average monthly flow below the Feather River confluence and at Freeport would not exceed 6 percent during all water years. In addition, during July, August, September, and October of all water years, flows would be higher up to about 4 percent under the CEQA Yuba Accord Alternative. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, would not unreasonably affect water quality in the Sacramento River.

Impact 9.2.3-8: Changes in monthly mean water temperatures in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type in the Sacramento River below the Feather River confluence (Appendix F4, 3 vs. 2, pg. 956) and at Freeport (Appendix F4, 3 vs. 2, pg. 1054) under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would be essentially equivalent except during August of wet, above normal, below normal, and dry water years when they would be up to 0.4ºF lower and 0.3ºF below the Feather River confluence.

Water temperatures below the Feather River confluence and at Freeport would be essentially equivalent approximately 100 percent of the time over the cumulative water temperature distribution with the exception of August at the mouth of the Feather River when water temperatures would be essentially equivalent about 50 percent of the time, and slightly lower 50 percent of the time over the cumulative water temperature distribution (Appendix F4, 3 vs. 2, pg. 981 through 992). Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, would not unreasonably affect water quality in the Sacramento River.

Impact 9.2.3-9: Changes to the monthly mean location of X2 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The location of the estuarine salinity gradient is regulated during the months of February through June by the location of X2 objective in the 1995 WQCP (D-1641). The X2 location must remain downstream of the Confluence of the Sacramento and San Joaquin rivers[17] (River Kilometer 81, located upstream from the Golden Gate Bridge) for the entire 5-month period. The X2 objective also specifies the number of days each month that that location of X2 must be downstream of Chipps Island (RK 74) or downstream of Roe Island[18] (RK 64). However, due to DSM2 modeling limitations these two locations are not evaluated (see Section 9.2.1.2).

The long-term average monthly mean X2 location from February through June under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative are presented in **Table 9-17**. During all months of the year, the long-term average and average location of X2 by water year would remain essentially equivalent during most months under CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative over the 72-year simulation period. Differences in X2 location under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would not exceed 0.4 percent (Appendix F4, 3 vs. 2, pg. 1189).

There would be two additional occurrences under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition when the monthly mean X2 location would be upstream of River Kilometer (RK) 81 in February of above normal and wet water years. The magnitude of these upstream shifts in X2 location would be 0.6 KM and 0.9 KM (Appendix F4, 3 vs. 2, pg. 1214 through 1225).

Table 9-17. Monthly Mean X2 Location (RK) from February Through June Over the 72-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative

Monthly Mean X2 Location (RK)					
Alternative	**Feb**	**Mar**	**Apr**	**May**	**Jun**
CEQA Yuba Accord Alternative	71.5	66.5	66.0	67.9	70.1
CEQA No Project Alternative	71.3	66.4	66.0	67.9	70.0

Delta outflow objectives established in SWRCB D-1641 extend throughout the year. For the February though June period under the CEQA Yuba Accord Alternative, Delta outflow objectives are met by compliance with the X2 objective. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Overall, simulated changes in the monthly mean X2 location under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, would not be of sufficient magnitude or frequency to adversely impact water quality resources in the Delta. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect water quality in the Delta.

[17] Also referred to as Collinsville.

[18] Also referred to as the Port Chicago EC monitoring station.

Impact 9.2.3-10: Changes to monthly mean Delta outflow that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

As described above, Delta outflow objectives established in SWRCB D-1641 extend throughout the year and are met by compliance with the X2 objective during the February though June period. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Over the entire 72-year period of simulated October through September outflows, differences in long-term average Delta outflows and average monthly outflows by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would not exceed 5 percent (Appendix F4, 3 vs. 2, pg. 1140). Average monthly flows under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative meet minimum outflow requirements, as defined in the SWRCB D-1641. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-11: Changes to monthly mean E/I ratios that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The Delta E/I ratio limits, established in SWRCB D-1641, specify that up to 35 percent of Delta inflows may be exported during the February through June period, and up to 65 percent of Delta inflows may be exported during the remaining months (i.e., July through January). These limits would be consistently met under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative. In addition, there would be no measurable differences in average monthly E/I ratios between the CEQA Yuba Accord Alternative and the CEQA No Project Alternative during most months, and differences that would occur would not exceed 5 percent (Appendix F4, 3 vs. 2, pg. 1238). Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-12: Salinity changes in the Sacramento River at Emmaton that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Emmaton during the April through August period range from 450 to 2,780 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Emmaton under the CEQA Yuba Accord Alternative, relative to the No Project Alternative, would range from 5.5 percent lower in August to 4.5 percent higher in June. Average salinities by water year type would decrease by five percent or more (up to 11.8 percent) during July, August and September of above normal and below normal years, and July of critical years. In addition, average salinities by water year type increase by five percent or more (up to 7.8 percent) during January of wet and dry years, May and June of dry years, and June of critical years (Appendix F5, 3 vs. 2, pg. 1).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 15.0 percent) during 7 of the 192 months modeled, and higher by ten percent or more (up to 15.2 percent) during 7 of the 192 months modeled. As a result of the decreases in monthly average salinities under the CEQA Yuba Accord Alternative, modeled EC values between April and August would be in compliance with D-1641 standards 4 additional times (all critical years in August), relative to the No Project Alternative. In addition, during the 13 modeled months in which neither the alternative nor the basis of comparison would comply with D-1641 standards, EC conditions would measurably improve (by up to 15.0 percent) under the CEQA Yuba Accord Alternative during 8 months, and would decline (by 6.6 percent) during 1 month (Appendix F5, 3 vs. 2, pg. 2 through 13).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, generally would occur during dry and critical years (**Table 9-18**). During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in salinity exhibited in the January and February output.

Table 9-18. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

	Salinity Change (µS/cm)		
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	941	15	Jan (1)
Above Normal	612	9	Dec (1)
Below Normal	---	---	---
Dry	265 - 2,035	5 - 15	Dec (1), Jan (2), Feb (1), May (3), Jun (2),
Critical	436 - 2,308	6 - 15	Dec (1), Jan (1), Feb (1), May (2), Jun (3)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16- year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent, relative to the basis of comparison.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality (**Table 9-19**).

Table 9-19. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

	Monthly Mean Salinity (µS/cm)											
	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,059	1,236	895	411	1,073	1,255	916	414	14 (1%)	19 (2%)	21 (2%)	3 (1%)
1987	2,128	1,321	456	188	2,036	1,257	460	189	-93 (-4%)	-63 (-5%)	4 (1%)	1 (0%)
1990	1,811	880	402	532	1,808	953	436	548	-3 (0%)	74 (8%)	34 (8%)	16 (3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.3-13: Salinity changes in the San Joaquin River at Jersey Point that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Jersey Point during the April through August period range from 450 to 2,200 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Jersey Point under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 4.4 percent lower in August to 5.3 percent higher in January. Average salinities by water year type would decrease by five percent or more (up to 10.2 percent) during July, August and September of above normal and below normal years, and July and August of critical years. In addition, average salinities by water year type would increase by five percent or more (up to 7.7 percent) during January of wet and dry years (Appendix F5, 3 vs. 2, pg. 14).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than under the CEQA No Project Alternative by ten percent or more (up to 17.0 percent) during 7 of the 192 months modeled, and higher by ten percent or more (up to 19.1 percent) during 6 of the 192 months modeled. As a result of the decreases in monthly average salinities under the CEQA Yuba Accord Alternative, modeled EC values between April and August would be in compliance with D-1641 standards during 5 additional months (1 above normal, 1 below normal, 1 dry, and 1 critical year in July; 1 critical year in August), relative to the CEQA No Project Alternative. In addition, during the 21 months in which neither alterative would comply with D-1641 salinity standards, EC conditions would measurably improve (by up to 15.3 percent) under the CEQA Yuba Accord Alternative during 8 months, and would measurably decline (by up to 7.9 percent) during 9 months (Appendix F5, 3 vs. 2, pg. 15 through 26).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, generally would occur during wet, dry, and critical years (**Table 9-20**). During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in salinity exhibited in the January and February output.

Table 9-20. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	453 - 1,545	5 - 11	Jan (1), Feb (1), Jul (1)
Above Normal	1,029	7	Dec (1)
Below Normal	---	---	---
Dry	380 - 1,925	6 -16	Dec (1), Jan (3), Feb (3), Jul (1)
Critical	475 - 2,430	5 - 19	Dec (1), Jan (2), Feb (2), May (1), Jun (1), Jul (2)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-21**).

Table 9-21. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,736	1,792	1,586	789	1,756	1,816	1,598	796	19 (1%)	24 (1%)	12 (1%)	7 (1%)
1987	2,022	1,785	953	275	1,906	1,688	944	277	-115 (-6%)	-97 (-5%)	-9 (-1%)	2 (1%)
1990	2,508	1,817	792	542	2,496	2,006	880	556	-13 (-1%)	189 (10%)	88 (11%)	14 (3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-14: Salinity changes in the San Joaquin River at Airport Way Bridge (Vernalis) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Airport Way Bridge (Vernalis) are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the CEQA Yuba Accord Alternative demonstrate no change in EC values, relative to the CEQA No Project Alternative (Appendix F5, 3 vs. 2, pg. 27). Similarly, monthly average salinities would be identical under each alternative, and consequently do not indicate changes in the ability to meet D-1641 compliance standards. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-15: Salinity changes in the San Joaquin River at Brandt Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Brandt Bridge are 700 μS/cm during the April through August period, and 1,000 μS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the CEQA Yuba Accord Alternative would have only negligible changes in EC values (i.e., up to 0.3 percent), relative to the CEQA No Project Alternative (Appendix F5, 3 vs. 2, pg. 40). Monthly average salinities also would remain similar under each alternative, with only 16 of the 192 months modeled indicating any difference and a maximum relative change of 1.3 percent (Appendix F5, 3 vs. 2, pg. 41 through 52). Consequently, monthly average salinities do not indicate changes in the ability to meet D-1641 compliance standards. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-16: Salinity changes in Middle River near Old River that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Middle River near Old River are 700 μS/cm during the April through August period, and 1,000 μS/cm during the September through March period.

Long-term average salinities under the CEQA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 1.0 percent change) to those under the CEQA No Project Alternative during all months of the year. In addition, changes in average salinities by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not exceed 1.5 percent. Monthly average salinities also would remain similar under each alternative, with a maximum relative change of 2.3 percent (Appendix F5, 3 vs. 2, pg. 53). Consequently, monthly average salinities would not indicate changes in the ability to meet D-1641 compliance standards. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-17: Salinity changes in Old River at Tracy Road Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Old River at Tracy Road Bridge are 700 μS/cm during the April through August period, and 1,000 μS/cm during the September through March period.

Long-term average salinities under the CEQA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 1.0 percent change) to those under the CEQA No Project Alternative during all months of the year. In addition, changes in average salinities by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not exceed 1.6 percent. Monthly average salinities also would remain similar under each alternative, with a maximum relative change of 4.3 percent (Appendix F5, 3 vs. 2, pg. 66). Consequently, monthly average salinities would not change the ability to meet D-1641 compliance standards. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-18: Salinity changes in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

CCWD's Los Vaqueros Intake and pumping plant is located just upstream of the Highway 4 Bridge. Because the Los Vaqueros Intake is located directly on Old River and is several miles upstream from the mouth of Rock Slough, the EC measurements at the Los Vaqueros Intake are usually lower than corresponding EC measurements at CCWD's Pumping Plant #1 (Reclamation and DWR 2005). Los Vaqueros Reservoir is used to provide emergency storage and water quality "blending" water to reduce chloride concentrations in CCWD's delivered water. As described in Reclamation's OCAP (Reclamation 2004), CCWD only is able to fill Los Vaqueros Reservoir when water quality conditions in the Delta are good, which generally occurs from January through July. There are no applicable EC objectives for Old River at Highway 4 (CCWD Los Vaqueros Intake) in D-1641.

Long-term average salinities at Highway 4 under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 4.2 percent lower in August to 3.5 percent higher in February. Average salinities by water year type would decrease by five percent or more (up to 9.8 percent) during August and September of above normal and below normal years, and August of critical years. In addition, average salinities by water year type would increase by five percent or more (5.3 percent) during January of dry years (Appendix F5, 3 vs. 2, pg. 79).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than those under the CEQA No Project Alternative by ten percent or more (up to 18.9 percent) during 3 of the 192 months modeled, and higher by ten percent or more (up to 18.9 percent) during 2 of the 192 months modeled (Appendix F5, 3 vs. 2, pg. 81 through 91).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, generally would occur during dry and critical years (**Table 9-22**). During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in salinity exhibited in the January and February output.

Table 9-22. Differences in Monthly Mean Salinity (µS/cm) in the Old River at Highway 4 (Los Vaqueros Intake), by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	487	9	Feb (1)
Above Normal	---	---	---
Below Normal	---	---	---
Dry	406 - 664	6 - 16	Jan (1), Feb (2), Jun (1), Jul (1), Aug (1)
Critical	429 - 920	5 - 19	Jan (2), Feb (2), Mar (1), Jun (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent, relative to the basis of comparison.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-23**).

Table 9-23. Differences in Monthly Mean Salinity (µS/cm) in Old River at Highway 4 (CCWD Los Vaqueros Intake), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	572	656	739	484	576	664	748	488	4 (1%)	8 (1%)	8 (1%)	3 (1%)
1987	673	650	662	380	662	608	644	379	-12 (-2%)	-42 (-6%)	-18 (-3%)	-2 (0%)
1990	688	878	586	376	685	921	663	397	-3 (0%)	42 (5%)	77 (13%)	21 (6%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-19: Salinity changes at CCWD Pumping Plant #1 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Sources of chlorides in Rock Slough include seawater, which intrudes into the Delta when freshwater outflow from the Delta is low, local drainage and seepage from adjacent lands, and the Sacramento and San Joaquin rivers. However, seawater and local drainage are of primary concern (DWR 2003b). There are no applicable EC objectives for CCWD Pumping Plant #1 in D-1641.

Long-term average salinities at CCWD Pumping Plant #1 under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 4.6 percent lower in

August to 3.6 percent higher in February. Average salinities by water year type would decrease by five percent or more (up to 10.2 percent) during August and September of above normal and below normal years, October of below normal years, and August of critical years. In addition, average salinities by water year type would increase by five percent or more (up to 5.5 percent) during January and February of dry years (Appendix F5, 3 vs. 2, pg. 92).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than those under the CEQA No Project Alternative by ten percent or more (up to 19.4 percent) during 4 of the 192 months modeled, and higher by ten percent or more (up to 20.0 percent) during 3 of the 192 months modeled (Appendix F5, 3 vs. 2, pg. 93 through 104).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, generally would occur during dry and critical years (**Table 9-24**). During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in salinity exhibited in the January and February output.

Table 9-24. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Salinity Change (µS/cm)			
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	648	10	Feb (1)
Above Normal	---	---	---
Below Normal	---	---	---
Dry	336 - 820	5 - 20	Jan (1), Feb (3), Jul (1), Aug (1)
Critical	395 - 1,070	6 - 20	Jan (2), Feb (2), Mar (1), Jun (1), Jul (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent, relative to the basis of comparison.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-25**).

Table 9-25. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
Year	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	637	744	852	542	642	753	862	546	4 (1%)	9 (1%)	10 (1%)	4 (1%)
1987	760	756	771	378	754	707	749	377	-5 (-1%)	-49 (-7%)	-22 (-3%)	-1 (0%)
1990	742	1,028	657	391	739	1,070	747	411	-3 (0%)	42 (4%)	90 (14%)	20 (5%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-20: Salinity changes in the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The SWP Banks Pumping Plant supplies water to the South Bay Aqueduct and the California Aqueduct. The applicable EC objective for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 1,000 µS/cm between October and September.

Long-term average salinities at Clifton Court Forebay under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 3.6 percent lower in September to 3.4 percent higher in February. Average salinities by water year type would decrease by five percent or more (up to 9.1 percent) during August and September of below normal and critical years, and September of above normal years. In addition, average salinities by water year type would not increase by five percent or more during any month or water year type (Appendix F5, 3 vs. 2, pg. 105).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would lower than those under the CEQA No Project Alternative by ten percent or more (up to 17.2 percent) during 5 of the 192 months modeled, and higher by ten percent or more (up to 18.2 percent) during 2 of the 192 months modeled (Appendix F5, 3 vs. 2, pg. 106 through 117). Modeled monthly average EC values under both alternatives between October and September would consistently be in compliance with D-1641 standards.

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, generally would occur during dry and critical years (**Table 9-26**). During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in salinity exhibited in the January and February output

Table 9-26. Differences in Monthly Mean Salinity (µS/cm) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant), by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Salinity Change (µS/cm)			
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	424 - 630	7 - 12	Jan (1), Feb (1), Jul (1), Aug (1)
Critical	443 - 724	5 - 18	Jan (1), Feb (2), Mar (1), Jul (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent, relative to the basis of comparison.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-27**).

Table 9-27. Differences in Monthly Mean Salinity (µS/cm) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
	CEQA No Project Alternative				**CEQA Yuba Accord Alternative**				**Absolute Difference (Relative Difference)[a]**			
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	522	601	694	569	524	607	700	571	3 (0%)	6 (1%)	6 (1%)	3 (0%)
1987	611	611	672	562	606	586	660	561	-6 (-1%)	-25 (-4%)	-12 (-2%)	-1 (0%)
1990	606	784	615	551	604	811	679	569	-2 (0%)	27 (3%)	64 (10%)	18 (3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-21: Salinity changes in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The Delta-Mendota Canal at the Jones Pumping Plant supplies drinking water to Jones and other communities. The applicable EC objective for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 1,000 µS/cm between October and September.

Long-term average salinities at Jones Pumping Plant under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 3.4 percent lower in August to 2.0 percent higher in February. Average salinities by water year type would decrease by five percent or more (up to 7.3 percent) during August and September of below normal years, September of above normal years, and August of critical years. In addition, average salinities by water year type would not increase by five percent or more during any month or water year type (Appendix F5, 3 vs. 2, pg. 118).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than those under the CEQA No Project Alternative by ten percent or more (up to 17.7 percent) during 2 of the 192 months modeled, and higher by ten percent or more (12.4 percent) during 1 of the 192 months modeled. Modeled monthly average EC values under both alternatives between October and September would consistently be in compliance with D-1641 standards (Appendix F5, 3 vs. 2, pg. 119 through 130).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, generally would occur during dry and critical years (**Table 9-28**). During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in salinity exhibited in the January and February output.

Table 9-28. Differences in Monthly Mean Salinity (µS/cm) in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	454 - 622	6 - 8	Jan (1), Jul (1), Aug (1)
Critical	699 - 739	7-12	Feb (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-29**).

Table 9-29. Differences in Monthly Mean Salinity (μS/cm) in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (μS/cm)												
Year	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	531	610	701	602	533	614	706	605	2 (0%)	5 (1%)	5 (1%)	2 (0%)
1987	609	618	681	586	605	596	671	585	-5 (-1%)	-22 (-4%)	-11 (-2%)	-1 (0%)
1990	612	774	641	572	610	795	698	590	-2 (0%)	22 (3%)	57 (9%)	18 (3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-22: Salinity changes at Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Middle River at Victoria Canal is an indicator of central Delta water quality and the water quality at Victoria Island agricultural siphons. There are no applicable EC objectives for Middle River at Victoria Canal noted in D-1641.

Long-term average salinities at Victoria Canal under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 2.6 percent lower in August to 2.3 percent higher in February. Average salinities by water year type would decrease by five percent or more (up to 6.3 percent) during September of below normal years and August of critical years. In addition, average salinities by water year type under the CEQA Yuba Accord Alternative would not increase by five percent or more during any month or water year type (Appendix F5, 3 vs. 2, pg. 131).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than those under the CEQA No Project Alternative by ten percent or more (up to 14.8 percent) during 2 of the 192 months modeled, and higher by ten percent or more (15.4 percent) during 1 of the 192 months modeled (Appendix F5, 3 vs. 2, pg. 132 through 143).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, generally would occur during dry and critical years (**Table 9-30**). During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in salinity exhibited in the January and February output.

Table 9-30. Differences in Monthly Mean Salinity (µS/cm) in Victoria Canal, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	454 - 622	6 - 8	Jan (1), Jul (1), Aug (1)
Critical	699 - 739	7-12	Feb (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent, relative to the basis of comparison.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-31**).

Table 9-31. Differences in Monthly Mean Salinity (µS/cm) in Victoria Canal, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	396	467	558	467	398	471	563	470	1 (0%)	4 (1%)	5 (1%)	3 (1%)
1987	494	482	560	471	493	463	546	469	0 (0%)	-20 (-4%)	-15 (-3%)	-2 (0%)
1990	450	612	532	405	448	625	591	427	-1 (0%)	13 (2%)	60 (11%)	22 (5%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-23: Salinity changes at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns related to the City of Stockton's water supply intake. Long-term average salinities at the Stockton Intake under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 3.2 percent lower in August to 2.5 percent higher in February. Average salinities by water year type would decrease by five percent or more (up to 7.9 percent) during August and

September of below normal years, September of above normal years, and August of critical years. In addition, average salinities by water year type under the CEQA Yuba Accord Alternative would not increase by five percent or more during any month or water year type (Appendix F5, 3 vs. 2, pg. 144).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 16.7 percent) during 3 of the 192 months modeled, and higher by ten percent or more (up to 16.1 percent) during 2 of the 192 months modeled (Appendix F5, 3 vs. 2, pg. 145 through 156).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative, generally would occur during dry and critical years (**Table 9-32**). During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in salinity exhibited in the January and February output.

Table 9-32. Differences in Monthly Mean Salinity (µS/cm) at the Stockton Intake, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Salinity Change (µS/cm)			
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	313 - 451	5 - 12	Jan (1), Feb (1), Jun (1), Jul (1), Aug (1)
Critical	315 - 574	5 - 16	Jan (2), Feb (2), Mar (1), Jul (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-33**).

Table 9-33. Differences in Monthly Mean Salinity (µS/cm) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

	Monthly Mean Salinity (µS/cm)											
	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	358	423	503	358	360	428	508	360	2 (1%)	5 (1%)	5 (1%)	2 (1%)
1987	409	421	462	341	402	399	452	340	-7 (-2%)	-22 (-5%)	-10 (-2%)	-1 (0%)
1990	444	543	433	303	442	574	483	315	-2 (0%)	31 (6%)	49 (11%)	12 (4%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-24: Changes in chloride concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objective for Old River at Highway 4 (CCWD Los Vaqueros Intake) in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations at Highway 4 under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would range from 6.3 percent lower in August to 8.2 percent higher in February. Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would not exceed about 5 percent except during August and September of above normal and below normal years when they would be about 12 percent lower; during February of dry years when they would be 12.7 percent higher; and during August of critical years when they would be 10.3 percent lower (Appendix F5, 3 vs. 2, pg. 157).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent would occur during 41 of the 192 months modeled. During these 41 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 23 occasions and lower on 18 occasions, relative to the CEQA No Project Alternative. Differences in monthly average chloride ion concentrations under the CEQA Yuba Accord Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 23.7 percent) during 12 of the 192 months modeled and higher by ten percent or more (up to 74.8 percent) during 7 of the 192 months modeled (Appendix F5, 3 vs. 2, pg. 158 through 169). Monthly average chloride ion concentrations from October through September are presented in **Table 9-34**.

Table 9-34. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake) from October Through September Over the 16-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	126.9	102.0	102.5	89.7	70.1	44.5	37.0	41.3	46.9	54.9	92.5	126.3
CEQA No Project Alternative	129.3	102.7	102.0	86.3	64.8	44.2	36.9	41.2	45.3	54.8	98.7	132.3

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta are similar in nature to those previously discussed for salinity. During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in chloride ion concentrations exhibited in the January and February output.

While simplifying assumptions are required to model the system, those simplifying may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-35**).

Table 9-35. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	113	137	161	61	114	139	163	61	1 (1%)	2 (2%)	2 (1%)	1 (1%)
1987	142	135	139	45	139	123	133	45	-3 (-2%)	-12 (-9%)	-5 (-4%)	0 (-1%)
1990	146	200	76	44	145	212	88	48	-1 (-1%)	12 (6%)	12 (15%)	3 (7%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-25: Changes in chloride concentrations in CCWD Pumping Plant #1 (Rock Slough) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for CCWD Pumping Plant #1 (Rock Slough) is 150 mg/l from year-round.

Long-term average chloride ion concentrations at the CCWD Pumping Plant #1 (Rock Slough) under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 0.2 percent lower in July to 4.0 percent higher in February. Differences in average chloride ion concentration by water year type would not exceed 5 percent except during August and September of below normal years when they would be 12.8 percent and 13.2 percent lower; August, September, and October of below normal years when they would be 7.2 percent, 11.9 percent, and 12.8 percent lower; February and June of dry years when they would be 6.7 percent and 5.5 percent higher; and August of critical years when they would be 10.4 percent lower (Appendix F5, 3 vs. 2, pg. 170).

Over the entire 16-year simulation period, monthly average chloride concentrations would exceed 150 mg/l under both the CEQA No Project Alternative and CEQA No Project Alternative during 42 of the 192 months modeled. During those 42 months when chloride ion concentrations would exceed 150 mg/l, concentrations would be lower under the CEQA No Project Alternative, relative to the CEQA Yuba Accord Alternative by 0.1 percent to 23.5 percent on 26 occasions, and higher by 0.6 percent to 6.4 percent on 16 occasions (Appendix F5, 3 vs. 2, pg. 171 through 182). There would also be 3 additional occurrences during above normal, dry and critical years under the CEQA No Project Alternative when monthly average chloride ion concentrations would exceed 150 mg/l by up to 20.6 percent, relative to the CEQA Yuba Accord Alternative. Monthly average chloride ion concentrations from October through September are presented in **Table 9-36**.

Table 9-36. Monthly Mean Chloride Ion Concentrations (mg/l) at CCWD Pumping Plant #1 (Rock Slough) from October Through September Over the 16-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
CEQA Yuba Accord Alternative	154.1	123.7	119.0	111.0	89.0	64.7	58.3	43.0	43.7	67.5	115.4	150.8
CEQA No Project Alternative	157.2	124.9	118.9	108.1	85.5	64.2	58.2	42.9	42.4	67.6	123.3	158.0

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta are similar in nature to those previously discussed for salinity. During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in chloride ion concentrations exhibited in the January and February output.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-37**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Table 9-37. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at CCWD Pumping Plant #1 (Rock Slough), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	113	135	147	90	114	137	149	91	1 (0%)	2 (1%)	2 (1%)	1 (1%)
1987	167	155	132	57	165	145	127	57	-2 (-1%)	-11 (-7%)	-5 (-3%)	0 (0%)
1990	158	185	108	61	156	193	123	64	-2 (-1%)	8 (4%)	16 (15%)	4 (6%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.3-26: Changes in chloride concentrations in Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives for Old River at Rock Slough (CCWD Intake) in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake. Long-term average chloride ion concentrations in the Old River at Rock Slough (CCWD Intake) under the CEQA Yuba Project Alternative, relative to the CEQA No Project Alternative, would range from 6.9 percent lower in October to 8.9 percent higher in February. Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would not exceed about 5 percent except during July, August, and September of above normal and below normal years when they would be 7 percent to 15 percent lower; and during August of critical years when they would be 10.6 percent lower (Appendix F5, 3 vs. 2, pg. 183).

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 250 mg/l under either the CEQA Yuba Accord Alternative or the CEQA No Project Alternative. However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 47 of the 192 months modeled. During these 47 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 27 occasions and lower on 20 occasions, relative to the CEQA No Project Alternative. Differences in chloride ion concentrations equal to or greater than 10 percent would occur during 22 of the 192 months modeled, and would be higher on 10 (up to 75.9 percent) occasions and lower on 12 (up to 24.0

percent) occasions under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F5, 3 vs. 2, pg. 184 through 195). Monthly average chloride ion concentrations from October through September are presented in **Table 9-38.**

Table 9-38. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Rock Slough (CCWD Intake) from October Through September Over the 16-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	143.7	111.7	115.2	95.1	67.1	35.9	28.8	32.1	34.6	62.9	113.9	154.1
CEQA No Project Alternative	146.4	112.6	114.4	90.5	61.6	35.7	28.8	32.0	33.1	63.9	122.4	160.9

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta are similar in nature to those previously discussed for salinity. During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in chloride ion concentrations exhibited in the January and February output.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-39**).

Table 9-39. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Rock Slough (CCWD Intake), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	135	158	177	57	136	161	180	58	2 (1%)	3 (2%)	3 (2%)	1 (1%)
1987	165	153	140	32	159	138	135	32	-6 (-3%)	-14 (-9%)	-5 (-4%)	0 (0%)
1990	182	224	73	37	181	242	85	39	-1 (-1%)	18 (8%)	12 (16%)	2 (7%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-27: Changes in chloride concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 5 percent lower in August and September to 7.5 percent higher in February. Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would not exceed about 5 percent except during August and September of above normal years when they would be 9 percent and 11.3 percent lower; August, September, and October when they would be 9.9 percent, 12.0 percent, and 5.9 percent lower during below normal years; and August and September when they would be 8.9 percent and 6.9 percent lower (Appendix F5, 3 vs. 2, pg. 196) .

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 250 mg/l under either the CEQA Yuba Accord Alternative or the CEQA No Project Alternative. However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 33 of the 192 months modeled. During these 33 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 16 occasions and lower on 18 occasions, relative to the CEQA No Project Alternative. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 13 of the 192 months modeled, and would be higher on 6 (up to 54.6 percent) occasions and lower on 7 (up to 22.8 percent) occasions under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F5, 3 vs. 2, pg. 197 through 208). Monthly average chloride ion concentrations from October through September are presented in **Table 9-40**.

Table 9-40. Monthly Mean Chloride Ion Concentrations (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant) from October Through September Over the 16-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative

	Monthly Average Chloride Ion Concentration (mg/l)											
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	100.1	86.3	82.6	75.7	61.0	45.0	38.8	40.1	47.0	46.3	68.4	94.2
CEQA No Project Alternative	102.1	87.0	82.5	73.8	56.8	44.5	38.7	40.2	46.9	45.7	72.0	99.2

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta are similar in nature to those previously discussed for salinity. During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in chloride ion concentrations exhibited in the January and February output.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-42**).

Table 9-41. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[1]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	85	105	128	64	86	107	130	65	1 (1%)	2 (2%)	2 (1%)	1 (1%)
1987	110	107	121	59	109	100	116	58	-1 (-1%)	-8 (-7%)	-4 (-4%)	0 (-1%)
1990	103	156	79	50	103	162	91	55	-1 (-1%)	6 (4%)	12 (15%)	4 (8%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-28: Changes in chloride concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 250 mg/l from October through September.

Long-term average chloride ion concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 0.5 percent lower in August to 5.4 percent higher in February. Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would not exceed approximately 5 percent except during August and September of above normal and below normal years when they would be 6.8 percent to 9.4 percent lower; February of dry years when they would be 13.5 percent higher; and August of critical years when they would be 9.3 percent lower (Appendix F5, 3 vs. 2, pg. 209).

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 250 mg/l under either the CEQA Yuba Accord Alternative or the CEQA No Project Alternative. However, differences in chloride ion concentrations would be equal to or greater than 5 percent would occur during 26 of the 192 months modeled. During these 26 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 11 occasions and lower on 15 occasions, relative to the CEQA No Project Alternative. Differences in chloride ion concentrations equal to or greater than 10 percent would occur during 8 of the 192 months modeled, and would be higher (up to 50.0 percent) on 3 occasions and lower (up to 22.2 percent) on 5 occasions under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F5, 3 vs. 2, pg. 210 through 221). Monthly average chloride ion concentrations from October through September are presented in **Table 9-42**.

Table 9-42. Monthly Mean Chloride Ion Concentrations (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) from October Through September Over the 16-year Simulation Period Under the CEQA Accord Alternative and the CEQA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	100.9	86.3	87.5	80.4	70.3	60.1	45.6	42.7	54.3	54.3	79.7	109.1
CEQA No Project Alternative	102.6	86.9	87.4	78.9	66.6	60.0	45.6	42.6	53.1	54.2	83.8	112.9

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta are similar in nature to those previously discussed for salinity. During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in chloride ion concentrations exhibited in the January and February output.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-43**).

Table 9-43. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	92	111	134	78	93	113	135	79	0 (1%)	1 (1%)	1 (1%)	0 (0%)
1987	111	113	129	76	110	108	126	76	-1 (-1%)	-5 (-5%)	-3 (-2%)	0 (0%)
1990	112	152	84	74	111	157	93	77	0 (0%)	5 (4%)	9 (10%)	3 (4%)

[a] Values in parentheses represent the relative difference in monthly mean salinity..

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-29: Changes in chloride concentrations in Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objective in Middle River at Victoria Canal in D-1641. However, Middle River at Victoria Canal is an indicator of central Delta water quality and water quality at the Victoria Island agricultural siphons, and is therefore evaluated.

Long-term average chloride ion concentrations in Middle River at Victoria Canal under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 4.5 percent lower in August to 5.4 percent higher in February. Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would not exceed approximately 5 percent except during September of above normal years when they would be 7.8 percent lower; August and September of below normal years when they would be 7.0 percent and 9.4 percent lower; and August and September of critical years when they would be 8.3 percent and 5.3 percent lower (Appendix F5, 3 vs. 2, pg. 222).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent would occur during 21 of the 192 months modeled. During these 21 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 10 occasions and lower on 11 occasions, relative to the CEQA No Project Alternative. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 8 of the 192 months modeled, and would be higher (up to 47.9 percent) on 3 occasions and lower (up to 20.9 percent) on 5 occasions under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F5, 3 vs. 2, pg. 223 through 234). Monthly average chloride ion concentrations from October through September are presented in **Table 9-44.**

Table 9-44. Monthly Mean Chloride Ion Concentrations (mg/l) in Middle River at Victoria Canal from October Through September Over the 16-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	75.8	69.9	63.2	63.0	57.0	46.0	41.7	47.4	54.9	39.6	48.7	66.0
CEQA No Project Alternative	76.8	70.3	63.2	61.9	54.1	45.8	41.6	47.5	53.8	38.9	51.0	68.6

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta are similar in nature to those previously discussed for salinity. During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in chloride ion concentrations exhibited in the January and February output.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-45**).

Table 9-45. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Middle River at Victoria Canal, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	59	76	98	58	59	77	99	58	0 (1%)	1 (1%)	1 (1%)	0 (1%)
1987	82	80	99	59	82	75	95	58	0 (0%)	-5 (-6%)	-4 (-4%)	0 (-1%)
1990	72	111	68	49	71	115	77	52	0 (0%)	3 (3%)	9 (13%)	3 (7%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-30: Changes in chloride concentrations at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objective at the Stockton Intake in D-1641. However, this location is evaluated to address potential concerns related to the City of Stockton's water supply intake.

Long-term average chloride ion concentrations at the Stockton Intake under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would range from 6.3 percent lower in August to 5.6 percent higher in February. Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would not exceed approximately 5 percent except during August and September of above normal and below normal water years when they would be about 10 percent to 12 percent lower; February of dry years when they would be 14.0 percent higher; and August of dry years when they would be 10.4 percent lower (Appendix F5, 3 vs. 2, pg. 235).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent would occur during 35 of the 192 months modeled. During these 35 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 18 occasions and lower on 17 occasions, relative to the CEQA No Project Alternative. Differences in monthly average chloride ion concentrations under the CEQA Yuba Accord Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 24.8 percent) during 12 of the 192 months modeled and higher by ten percent or more (up to 41.0 percent) during 6 of the 192 months modeled (Appendix F5, 3 vs. 2, pg. 236 through 247). Monthly average chloride ion concentrations from October through September are presented in **Table 9-46**.

Table 9-46. Monthly Mean Chloride Ion Concentrations (mg/l) at the Stockton Intake from October Through September Over the 16-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative

	Monthly Average Chloride Ion Concentration (mg/l)											
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	57.4	50.3	46.2	46.7	41.0	32.2	36.3	44.1	32.8	26.1	36.7	49.6
CEQA No Project Alternative	58.1	50.5	45.9	44.9	38.8	32.1	36.3	44.0	31.7	26.3	39.1	51.7

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta are similar in nature to those previously discussed for salinity. During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in chloride ion concentrations exhibited in the January and February output.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-47**).

Table 9-47. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA No Project Alternative				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	49	65	85	42	50	66	86	42	1 (1%)	1 (2%)	1 (1%)	0 (1%)
1987	62	65	75	39	60	59	72	39	-2 (-3%)	-5 (-8%)	-3 (-3%)	0 (0%)
1990	70	95	53	33	70	102	60	35	0 (-1%)	7 (8%)	7 (14%)	2 (6%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.3-31: Changes in DOC concentrations at Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no DOC objectives in D-1641 for any location within the Delta. However, consideration of data regarding the average DOC concentrations in the Delta, assumed levels of natural variation, and assumed relationships between DOC concentrations and THM formation in drinking water has resulted in establishment of a monthly change significance criterion for DOC of 0.4 mg/l (see Section 9.2.2.1).

Long-term average DOC concentrations at Highway 4 under the CEQA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to those under the CEQA No Project Alternative during all months of the year (Appendix F5, 3 vs. 2, pg. 248). In addition, changes in average DOC concentrations by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.2 mg/l. Consequently, changes in the monthly average DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-32: Changes in DOC concentrations at Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations in the Old River at Rock Slough under the CEQA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to those under the CEQA No Project Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations also remain similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 3 vs. 2, pg. 261). Consequently, changes in the monthly average DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-33: Changes in DOC concentrations at West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations at Clifton Court Forebay under the CEQA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA No Project Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations also remain similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 3 vs. 2, pg. 274). Consequently, changes in the monthly average DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-34: Changes in DOC concentrations at the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average DOC concentrations at Jones Pumping Plant under the CEQA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA No Project Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the CEQA Yuba Accord Alternative, relative to the No Project Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations also remain similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 3 vs. 2, pg. 287). Consequently, changes in the monthly average DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-35: Changes in monthly mean flows in Old River at Bacon Island that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Old River at Bacon Island under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would not exceed approximately 2 percent during most months (Appendix F5, 3 vs. 2, pg. 300). The direction of flow under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative moves towards the Delta pumps during all months and water years except during February through April of wet years. The magnitude to flows moving towards Delta pumps during February through May of all water years would be essentially equivalent or reduced during most months and water years under the CEQA Yuba Accord Alternative. In general, the magnitude of flows moving towards Delta pumps under the CEQA Yuba Accord Alternative during wet, above normal, and below normal years is between about 3 cfs and about 130 cfs higher from July through September. Increases the magnitude of flows moving towards Delta pumps occur less frequently in dry and critical years and would be between about 1 cfs and 130 cfs higher compared to the CEQA No Project Alternative.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 61 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 131 months (Appendix F5, 3 vs. 2, pg. 301 through 312).

Overall, potential changes in monthly mean flows under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA Yuba Accord Alternative would not unreasonably affect Delta water quality.

Impact 9.2.3-36: Changes in monthly mean flows in the Middle River at Middle River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Middle River at Middle River would not exceed about 2 percent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F5, 3 vs. 2, pg. 313). The direction of flow under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would move towards the Delta pumps during all months and water years. The magnitude of flows moving towards Delta pumps under the CEQA Yuba Accord and CEQA No Project alternatives during February through May would be reduced, and would be essentially equivalent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative during most months and water years except during May of dry years. During these times the rate of flow movement towards Delta pumps would be up to about 25 cfs lower under the CEQA Yuba Accord Alternative. In general, the magnitude of flows moving towards Delta pumps under the CEQA Yuba Accord Alternative would be between about 2 cfs and about 90 cfs higher from July through September and essentially equivalent to about 80 cfs lower during all other months.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 61 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 131 months (Appendix F5, 3 vs. 2, pg. 366 through 367).

Overall, potential changes in monthly mean flows under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-37: Changes in monthly mean flows in the Middle River at Mowry Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Middle River at Mowry Bridge would be essentially equivalent during all months except October during which they would be about 1 percent lower under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative over the 16-year simulation period (Appendix F5, 3 vs. 2, pg. 378). The direction of flow under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would move away from the Delta pumps and would be essentially equivalent during most months and water years. Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 3 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 189 months (Appendix F5, 3 vs. 2, pg. 327 through 338).

Overall, potential changes in monthly mean flows under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.3-38: Decreases in San Luis Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Historically, the CVP and SWP have cooperated to try to maintain San Luis Reservoir above 300 TAF in response to the low-point problem and thus, avoid adverse impacts to water quality. Combined long-term average monthly CVP and SWP reservoir storage and average monthly reservoir storage by water year type under the CEQA Yuba Accord Alternative would be essentially equivalent in San Luis Reservoir, relative to the CEQA No Project Alternative over the 72-year simulation period (Appendix F4, 3 vs. 2, pg. 1339 and 1376). Differences in reservoir storage during all months and water years would not exceed 5 percent. In addition, there would be no additional months under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative when the combined CVP and SWP monthly mean reservoir storage drops below 300 TAF (Appendix F4, 3 vs. 2, pg. 1340 through 1351; and 1377 through 1388). Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect water quality in San Luis Reservoir.

9.2.4 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE CEQA MODIFIED FLOW ALTERNATIVE COMPARED TO THE CEQA NO PROJECT ALTERNATIVE

Impact 9.2.4-1: Decreases in New Bullards Bar Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year simulation period, differences in long-term average end-of-month storage under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would not exceed 4 percent over the 72-year simulation period. Average end-of-month storage by water year type would be generally lower by up to 9 percent during wet, above normal, and below normal water years, and higher during most months by up to 14 percent during dry and critical water years under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. During August, September, October, and November of most water years, reservoir storage volumes are typically lowest due to reservoir storage releases occurring from

July through September. Differences in monthly mean storage would be on average about 2 percent lower in August, September, October, and November under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pg. 1). During periods (i.e., October and November) exhibiting the lowest storage conditions[19] on record for New Bullards Bar Reservoir, storage would be about 10 percent higher nearly all of the time under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 26 through 37).

Generally, a greater volume of water present in the reservoir equates to a greater amount of dilution regarding any constituent of concern that may be present in the water. However, the magnitude and frequency (i.e., up to 10 percent lower 25 percent of the time during October and November) of the changes in reservoir storage levels simulated under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not be likely to cause metals and other constituents of concern that may be concentrated in the sediments at the bottom of the reservoir to be re-suspended and degrade long-term water quality. In addition, decreases in water quality in New Bullards Bar due to increases in water temperature would be unlikely to occur due to its steep-sided conical shape, which creates sufficient water depths to maintain a large cold pool reservoir under all operational reservoir levels throughout the year.

As a result of the water transfers occurring from July through September under the CEQA Modified Flow Alternative, large reductions in New Bullards Bar Reservoir storage would be expected to occur during the late summer and fall. However, the frequency and magnitude of these reductions in storage would not be sufficient to reduce the long-term water quality in New Bullards Bar Reservoir due to the morphology of the reservoir. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect water quality in New Bullards Bar Reservoir.

Impact 9.2.4-2: Changes in monthly mean flows in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

During the seasonal high flow period[20], long-term average flows in the lower Yuba River at Smartville would range from about 1 percent lower in April to approximately 7 percent lower in December under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative over the 72-year simulation period. During the seasonal low flow period[21], long-term average flows in the lower Yuba River at Smartville would range from approximately 10 percent lower in November and up to 21 percent higher in August, September, and October under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Maximum decreases in monthly mean flow under the CEQA Modified Flow Alternative would range from about 25 percent to 30 percent and would occur during June and July of critical years (Appendix F4, 4 vs. 2, pg. 100). During typically low flow conditions[22], flows under the CEQA Modified Flow Alternative would be higher about 40 percent of the time in August, and lower about 65 percent of the time in September by an average about 15 percent; and higher about 70 percent of the time by an average of about 20 percent during October and November, compared to those under the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 125, 126, 135, and 136).

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[19] The lowest 25 percent of the monthly cumulative probability flow distribution

[20] Generally, December through June in the lower Yuba River.

[21] Generally, August through November in the lower Yuba River.

During the seasonal high flow period, differences in long-term average flows in the lower Yuba River at Marysville do not exceed approximately 7 percent under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative over the 72-year simulation period. During the seasonal low flow period, long-term average flows in the lower Yuba River at Marysville would range from approximately 10 percent lower in November to 45 percent higher in August under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Maximum decreases in average monthly flow under the CEQA Modified Flow Alternative would range from about 20 percent to about 60 percent, and occur during June and July of dry and critical water years (Appendix F4, 4 vs. 2, pg. 272). During typically low flow conditions flows under the CEQA Modified Flow Alternative would be on average about 30 percent higher in August about 75 percent of the time; 15 percent lower in September 100 percent of the time; 5 percent lower in October about 50 percent of the time; and 5 percent higher in November 90 percent of the time compared to those under the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 297, 298, 307, and 308).

Overall, lower Yuba River flows under the CEQA Modified Flow Alternative would be higher than flows under the CEQA No Project Alternative. Increased lower Yuba River flows would allow dilution of water quality constituents, including pesticides and fertilizers from agricultural runoff, potentially having a beneficial effect on water quality. Changes in the frequency and magnitude of flows in the lower Yuba River would not result in any long-term impacts to designated beneficial uses, existing regulatory standards, degradation of general water quality. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect water quality in the lower Yuba River.

Impact 9.2.4-3: Changes in monthly mean water temperatures in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average water temperatures in the lower Yuba River at Smartville under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would be essentially equivalent[22] during all months (Appendix F4, 4 vs. 2, pg. 174). Long-term average water temperatures at Marysville would be essentially equivalent during most months, but would increase in May and June and would decrease (up to 1.7ºF) in July and August under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Long-term average monthly water temperatures and average monthly water temperatures by water year in the lower Yuba River do not exceed 67ºF under the CEQA Modified Flow Alternative (Appendix F4, 4 vs. 2, pg. 346).

Under the CEQA Modified Flow Alternative, long-term average water temperatures at Daguerre Point Dam during the April through July rice field flooding and planting period would be essentially equivalent during most months, and would decrease slightly (0.7ºF) in July compared to those under the CEQA No Project Alternative. However, water temperatures during these months would not exceed about 58ºF under either alternative. For all water years, average monthly water temperatures at Daguerre Point Dam would be essentially equivalent during most months under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, and would remain below 60ºF under both alternatives (Appendix F4, 4 vs. 2, pg. 223). Over the 72-year simulation period, there is one occurrence when monthly mean

[22] Essentially equivalent refers to water temperature differences between the alternative and the basis of comparison that are less than 0.3 ºF (See Section 9.2.1).

water temperatures in July would exceed 65ºF by approximately 2ºF (Appendix F4, 4 vs. 2, pg. 257).

Overall, lower Yuba River water temperatures under the CEQA Modified Flow Alternative would be similar to the CEQA No Project Alternative. Water temperature changes occurring in the lower Yuba River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not change water temperatures to a level that would unreasonably affect water quality in the lower Yuba River.

Impact 9.2.4-4: Decreases in Oroville Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average end-of-month Oroville Reservoir storage would be essentially equivalent[23] under the CEQA Modified Flow and the CEQA No Project Alternative. Differences in average end-of-month storage under the CEQA Modified Flow Alternative would not exceed 1 percent in any water year (Appendix F4, 4 vs. 2, pg. 406). During all months, the cumulative reservoir storage distributions would be essentially equivalent over 90 percent of the time, under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 431 through 442). Therefore, the CEQA Modified Flow Alternative compared to the CEQA No Project Alternative, would not unreasonably affect water quality in Oroville Reservoir.

Impact 9.2.4-5: Changes in monthly mean flows in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly flows or average monthly flows by water year type in the Feather River below the Fish Barrier Dam under the CEQA Modified Flow Alternative, compared to those under the CEQA No Project Alternative.

Over the 72-year simulation period differences in long-term average monthly flows in the Feather River below the Thermalito Afterbay Outlet would not exceed about 2 percent under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pg. 603). Differences in long-term average monthly flows in the Feather River at the mouth under the CEQA Modified Flow Alternative would be up to approximately 3 percent lower and up to about 5 percent higher during some months (Appendix F4, 4 vs. 2, pg. 775). Decreases in average monthly flow below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative do not exceed approximately 9 percent during all water years, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pg. 603). Decreases in average monthly flow at the mouth of the Feather River under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative do not exceed approximately 7 percent during all water years with the exception of critical years, during which flows would be about 12 percent and about 18 percent lower in May and June, respectively (Appendix F4, 4 vs. 2, pg. 775).

During low flow conditions occurring from September through November, flows below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be essentially

[23] Essentially equivalent refers to differences in water storage volumes under the alternative and the basis of comparison that are less than or equal to 1 percent (See Section 9.2.1).

equivalent[24] 80 percent to 100 percent of the time (Appendix F4, 4 vs. 2, pgs. 639, 628, and 629). During low flow conditions at the mouth of the Feather River flows under the CEQA Modified Flow Alternative would be essentially equivalent and higher on average by up to 4 percent, 85 percent to 100 percent of the time, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 811, 800, and 801).

Overall, lower Feather River flows under the CEQA Modified Flow Alternative would not substantially change compared to those under the CEQA No Project Alternative and, thus, would not be expected to degrade water quality or adversely affect beneficial uses. Therefore, the CEQA Modified Flow Alternative, compared to those under the CEQA No Project Alternative, would not unreasonably affect water quality in the lower Feather River.

Impact 9.2.4-6: Changes in monthly mean water temperatures in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses.

Monthly mean water temperatures and average monthly water temperatures by water year type in the lower Feather River below the Fish Barrier Dam and the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be essentially equivalent to the CEQA No Project Alternative. Long-term average monthly water temperatures would be essentially equivalent under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative during all months except July and August, during which they would be 0.5ºF and 0.6ºF lower, respectively. Differences in average monthly water temperatures by water year type at the mouth of the Feather River, relative to the CEQA No Project Alternative, would be essentially equivalent during most months except July and August of wet, above normal, below normal, and dry water years when they would be 0.5ºF to 1.1ºF lower under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pg. 824).

Water temperatures below the Thermalito Afterbay Outlet would be essentially equivalent during all months under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative 90 percent to 100 percent of the time over the cumulative water temperature distribution (Appendix F4, 4 vs. 2, pgs. 702 through 713). At the mouth of the Feather River, water temperatures would be essentially equivalent about 100 percent of the time during all months of the cumulative water temperature distribution with the exception of May, June, July, and August. During May water temperatures would be essentially equivalent about 65 percent of the time and higher by an average of 0.6ºF about 35 percent of the time; during June water temperatures would be essentially equivalent 80 percent of the time and higher by an average of 0.5ºF 20 percent of the time; during July water temperatures would be essentially equivalent 20 percent of the time and lower by an average of 0.6ºF; and would be lower by an average of 0.7ºF 95 percent of the time in August under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 849 through 860).

Overall, lower Feather River water temperatures under the CEQA Yuba Accord Alternative would be similar to the CEQA No Project Alternative. Water temperature changes that could potentially occur in the lower Feather River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect water quality in the lower Feather River.

[24] Essentially equivalent refers to differences in flow under the alternative and the basis of comparison that are less than or equal to 1 percent (See Section 9.2.1).

Impact 9.2.4-7: Changes in monthly mean flows in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows and average monthly flows by water year type in the Sacramento River below the confluence with the Feather River and at Freeport under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would not exceed approximately 3 percent and would be essentially equivalent during most months over the 72-year simulation period (Appendix F4, 4 vs. 2, pgs. 907 through 918 and 1030 through 1041). Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect water quality in the Sacramento River.

Impact 9.2.4-8: Changes in monthly mean water temperatures in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative in the Sacramento River below the Feather River confluence and at Freeport would be essentially equivalent, or up to 0.4°F lower under the CEQA Modified Flow Alternative during July of wet years, as well as August of above normal years (Appendix F4, 4 vs. 2, pgs. 956 and 1054).

Water temperatures below the Feather River confluence and at Freeport would be essentially equivalent and lower during all months under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative approximately 100 percent of the time over the cumulative water temperature distribution (Appendix F4, 4 vs. 2, pgs. 981 through 992 and 1079 through 1090). Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect water quality in the Sacramento River.

Impact 9.2.4-9: Changes to the monthly mean location of X2 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The location of the estuarine salinity gradient is regulated during the months of February through June by the location of X2 objective in the 1995 WQCP (D-1641). The X2 location must remain downstream of the Confluence of the Sacramento and San Joaquin rivers[25] (River Kilometer 81, located upstream from the Golden Gate Bridge) for the entire 5-month period. The X2 objective also specifies the number of days each month that the location of X2 must be downstream of Chipps Island (RK 74) or downstream of Roe Island[26] (RK 64). However, due to DSM2 modeling limitations these two locations are not evaluated (see Section 9.2.1)

The long-term average monthly mean X2 location from February through June under the CEQA Modified Flow Alternative and the CEQA No Project Alternative are presented in **Table 9-48**. The long-term average monthly mean X2 location would range from essentially equivalent in March and May to 0.2 km higher during February. The long-term average X2 location by water year type would range from essentially equivalent to 0.3 km upstream in June of critical years under CEQA Modified Flow Alternative (Appendix F4, 4 vs. 2, pg. 1189). Under the CEQA Modified Flow Alternative, there would be one occurrence in February when the monthly mean X2 location would be upstream of the Confluence (RK 81) (Appendix F4, 4 vs. 2, pg. 1194).

[25] Also referred to as Collinsville.

[26] Also referred to as the Port Chicago EC monitoring station.

Table 9-48. Long-term Average Monthly Mean X2 Location (RK) from February Through June Under the CEQA Modified Flow Alternative and the CEQA No Project Alternative.

Long-term Average[a] Monthly Mean X2 Location (RK)					
Alternative	**Feb**	**Mar**	**Apr**	**May**	**Jun**
CEQA Modified Flow Alternative	71.3	66.4	65.9	67.9	70.0
CEQA No Project Alternative	71.5	66.4	66.0	67.9	70.1

[a] Over the 72-year simulation period

Delta outflow objectives established in SWRCB D-1641 extend throughout the year. For the February though June period under the CEQA Modified Flow Alternative, Delta outflow objectives would be met by compliance with the X2 objective. Delta outflow objectives would be met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Overall, simulated changes in the monthly mean X2 location under the CEQA Modified Flow Alternative would not be of sufficient magnitude or frequency to adversely impact water quality resources in the Delta. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not change the X2 location such that it would unreasonably affect Delta water quality.

Impact 9.2.4-10: Changes to monthly mean Delta outflow that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

As described above, Delta outflow objectives established in SWRCB D-1641 extend throughout the year and would be met by compliance with the X2 objective during the February though June period. Delta outflow objectives would be met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641.

Long-term average Delta outflow would be essentially equivalent with the exception of June which would be 3 percent lower under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Average monthly outflows by water year type under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would meet minimum outflow requirements, as defined in the SWRCB D-1641. Differences Delta outflows between the alternatives would not exceed 3 percent except June of dry and critical years when they would be 4 percent and 18 percent lower under the CEQA Modified Flow Alternative (Appendix F4, 4 vs. 2, pg. 1140). These differences would not be of sufficient magnitude or frequency to adversely impact water quality resources in the Delta. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-11: Changes to the monthly mean E/I ratios that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The Delta E/I ratio limits, established in SWRCB D-1641, specify that up to 35 percent of Delta inflows may be exported during the February through June period, and up to 65 percent of Delta inflows may be exported during the remaining months (i.e., July through January). These limits would be consistently met under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative. In addition, differences in average monthly E/I ratios between the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be essentially equivalent during most months, and differences that occur would not exceed 5 percent over the 72-year simulation period (Appendix F4, 4 vs. 2, pg. 1238). Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-12: Salinity changes in the Sacramento River at Emmaton that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Emmaton during the April through August period range from 450 to 2,780 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Emmaton under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 2.5 percent lower in August to 6.7 percent higher in June. Average salinities by water year type would decrease by five percent or more (up to 11.9 percent) during July, August and September of above normal and below normal years. In addition, average salinities by water year type would increase by five percent or more (up to 9.1 percent) during January of wet years, and May and June of dry and critical years (Appendix F5, 4 vs. 2, pg. 1).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 15.5 percent) during 3 of the 192 months modeled, and higher by ten percent or more (up to 23.3 percent) during 8 of the 192 months modeled. Under the CEQA Modified Flow Alternative, modeled EC values between April and August would be in compliance with D-1641 standards 2 additional times (1 dry and 1 critical year in August), relative to the CEQA No Project Alternative. In addition, during the 19 modeled months in which neither alternative would comply with D-1641 standards, EC conditions would measurably improve (by up to 15.5 percent) under the CEQA Modified Flow Alternative during 9 months, and decline (by up to 16.8 percent) during 5 month (Appendix F5, 4 vs. 2, pgs. 2 through 13).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Modified Flow Alternative, compared to those under the CEQA No project Alternative, and generally would occur during dry and critical years (**Table 9-49).**

Table 9-49. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, by Water Year Type, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative.

Salinity Change (µS/cm)			
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	940	15	Jan (1)
Above Normal	622	11	Dec (1)
Below Normal	---	---	---
Dry	280 - 945	6 - 17	Jan (2), May (2), Jun (2),
Critical	407 - 2300	5 - 23	Dec (1), Jan (2), Feb (1), May (3), Jun (4)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.

[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-50**).

Table 9-50. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,059	1,236	895	411	1,073	1,255	916	414	14 (1%)	19 (2%)	21 (2%)	3 (1%)
1987	2,128	1,321	456	188	1,841	1,095	436	187	-288 (-4%)	-226 (-17%)	-20 (-4%)	-1 (0%)
1990	1,811	880	402	532	1,831	882	408	542	20 (1%)	2 (0%)	6 (1%)	10 (2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.4-13: Salinity changes in the San Joaquin River at Jersey Point that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Jersey Point during the April through August period range from 450 to 2,200 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Jersey Point under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 2.5 percent lower in August to 4.2 percent higher in June. Average salinities by water year type would decrease by five percent or more (up to 10.4 percent) during August and September of above normal and below normal years. In addition, average salinities by water year type would increase by five percent or more (up to 5.9 percent) during May and June of critical years (Appendix F5, 4 vs. 2, pg. 14).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 15.2 percent) during 3 of the 192 months modeled, and higher by ten percent or more (up to 16.6 percent) during 7 of the 192 months modeled. Under the CEQA Modified Flow Alternative, modeled EC values between April and August would be in compliance with D-1641 standards during 3 additional months (1 above normal, 1 below normal, and 1 dry year in July), compared to those under the CEQA No Project Alternative. In addition, during the 23 months in which neither alterative would comply with D-1641 salinity standards, EC conditions would measurably improve (by up to 15.2 percent) under the CEQA Modified Flow Alternative during 7 months, and measurably decline (by up to 8.4 percent) during 6 months (Appendix F5, 4 vs. 2, pgs. 15 through 26).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Modified Flow Alternative, compared to those under the CEQA No Project Alternative, and generally would occur during dry and critical years (**Table 9-51**).

Table 9-51. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, by Water Year Type, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative.

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	1544	11	Jan (1)
Above Normal	1121	5	Dec (1)
Below Normal	---	---	---
Dry	358 - 827	6 - 10	Jan (2), Feb (1), May (1), Jun (1),
Critical	361 - 1841	5 - 17	Dec (1), Jan (2), Feb (2), May (3), Jun (2)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts previously described are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-52**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Table 9-52. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,736	1,792	1,586	789	1,756	1,816	1,598	796	19 (1%)	24 (1%)	12 (1%)	7 (1%)
1987	2,022	1,785	953	275	1,673	1,456	877	270	-349 (-7%)	-329 (-8%)	-76 (-8%)	-5 (-2%)
1990	2,508	1,817	792	542	2,479	1,842	797	544	-30 (-1%)	25 (1%)	5 (1%)	2 (0%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.4-14: Salinity changes in the San Joaquin River at Airport Way Bridge (Vernalis) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Airport Way Bridge (Vernalis) are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the CEQA Modified Flow Alternative indicate no change in EC values, relative to the CEQA No Project Alternative. Similarly, monthly average salinities also would be identical under each alternative, and consequently do not indicate changes in the ability to meet D-1641 compliance standards (Appendix F5, 4 vs. 2, pg. 27). Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-15: Salinity changes in the San Joaquin River at Brandt Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Brandt Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period .(Appendix F5, 4 vs. 2, pg. 40).

Long-term average salinities and average salinities by water year type under the CEQA Modified Flow Alternative would have only negligible changes in EC values (i.e., up to 0.1 percent), relative to the CEQA No Project Alternative. Monthly average salinities also would be similar under each alternative, with only 12 of the 192 months modeled indicating any difference with a maximum relative change of up to 0.4 percent (Appendix F5, 4 vs. 2, pgs. 41 through 52). Consequently, monthly average salinities would meet D-1641 compliance standards. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-16: Salinity changes in Middle River near Old River that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Middle River near Old River are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA No Project Alternative during all months of the year. In addition, changes in average salinities by water year type under the CEQA Modified Flow Alternative, would not exceed 1.6 percent (Appendix F5, 4 vs. 2, pg. 53). Monthly average salinities also would be similar under each alternative, with a maximum relative change of 2.9 percent. Consequently, monthly average salinities would meet D-1641 compliance standards (Appendix F5, 4 vs. 2, pgs. 54 through 65). Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-17: Salinity changes in Old River at Tracy Road Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Old River at Tracy Road Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

During all months of the year long-term average salinities under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA No Project Alternative. In addition, changes in average salinities by water year type under the CEQA Modified Flow Alternative would not exceed 1.6 percent. Monthly average salinities also would be similar under each alternative, with a maximum relative change of 2.2 percent (Appendix F5, 4 vs. 2, pgs. 67 through 78). Consequently, monthly average salinities would meet D-1641 compliance standards. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-18: Salinity changes in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641. However this location is evaluated to address potential concerns related to the CCWD's water supply intake and potential impacts associated with Los Vaqueros Reservoir water supplies.

Long-term average salinities at Highway 4 under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 2.1 percent lower in September to 2.2 percent higher in February. Average salinities by water year type would decrease by five percent or more (up to 9.8 percent) during August and September of above normal and below normal years. Average salinities by water year type would not increase by five percent or more during any month or water year type (Appendix F5, 4 vs. 2, pg. 79).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 14.3 percent) during 2 of the 192 months modeled, and would not be higher by ten percent or more during any month modeled (Appendix F5, 4 vs. 2, pgs. 80 through 91).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Modified Flow Alternative, compared to the CEQA No Project Alternative, generally would occur during dry and critical years (**Table 9-53**).

Table 9-53. Differences in Monthly Mean Salinity (μS/cm) in the Old River at Highway 4 (Los Vaqueros Intake), by Water Year Type, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative.

	Salinity Change (μS/cm)		
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	487	9	Feb (1)
Above Normal	---	---	---
Below Normal	---	---	---
Dry	410	7	Jun (1)
Critical	378 - 748	6 - 7	Jan (1), Feb (2), Jun (2), Jul (2)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison..

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-54**).

Table 9-54. Differences in Monthly Mean Salinity (µS/cm) in Old River at Highway 4 (CCWD Los Vaqueros Intake), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Year	Monthly Mean Salinity (µS/cm)											
	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	572	656	739	484	576	664	748	488	4 (1%)	8 (1%)	8 (1%)	3 (1%)
1987	673	650	662	380	641	524	589	368	-32 (-5%)	-125 (-19%)	-73 (-11%)	-13 (-3%)
1990	688	878	586	376	679	873	599	379	-8 (-1%)	-5 (-1%)	13 (2%)	4 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.4-19: Salinity changes at CCWD Pumping Plant #1 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Sources of chlorides in Rock Slough include seawater, which intrudes into the Delta when freshwater outflow from the Delta is low, local drainage and seepage from adjacent lands, and the Sacramento and San Joaquin rivers. Seawater and local drainage are the primary concerns (DWR 2003b). There are no applicable EC objectives for CCWD Pumping Plant #1 noted in D-1641.

Long-term average salinities at CCWD Pumping Plant #1 under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 2.3 percent lower in September to 2.6 percent higher in June. Average salinities by water year type would decrease by five percent or more (up to 10.3 percent) during August and September of above normal and below normal years, and October of below normal years. Average salinities by water year type would not increase by five percent or more during any month or water year type (Appendix F5, 4 vs. 2, pg. 92).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 15.8 percent) during 3 of the 192 months modeled, and higher by ten percent or more (up to 10.4 percent) during 2 of the 192 months modeled (Appendix F5, 4 vs. 2, pgs. 93 through 104).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Modified Flow Alternative, compared to the CEQA No Project Alternative, generally would occur during dry and critical years (**Table 9-55**).

Table 9-55. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA No Project Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	648	10	Feb (1)
Above Normal	---	---	---
Below Normal	---	---	---
Dry	337 - 343	5 - 7	Feb (1), Jun (1)
Critical	359 - 861	6 - 10	Jan (1), Feb (2), Jun (2), Jul (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-56**).

Table 9-56. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	637	744	852	542	642	753	862	546	4 (1%)	9 (1%)	10 (1%)	4 (1%)
1987	760	756	771	378	744	611	683	366	-16 (-2%)	-145 (-19%)	-88 (-11%)	-12 (-3%)
1990	742	1,028	657	391	734	1,019	672	393	-8 (-1%)	-8 (-1%)	15 (2%)	2 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.4-20: Salinity changes in the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The applicable EC objective for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 1,000 µS/cm year-round.

Long-term average salinities at Clifton Court Forebay under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 2.1 percent lower in September to 2.0 percent higher in February. Average salinities by water year type would decrease by five percent or more (up to 9.1 percent) during August and September of above normal and below normal years. In addition, average salinities by water year type would not increase by five percent or more during any month or water year type (Appendix F5, 4 vs. 2, pg. 105).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 13.1 percent) during 2 of the 192 months modeled (Appendix F5, 4 vs. 2, pgs. 106 through 117). Modeled monthly average EC values under both alternatives between October and September would comply with D-1641 standards. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-21: Salinity changes in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The applicable EC objective for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 1,000 µS/cm year-round.

Long-term average salinities at Jones Pumping Plant under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 1.5 percent lower in September to 1.2 percent higher in July. Average salinities by water year type would decrease by five percent or more (up to 5.9 percent) during August and September of below normal years, and September of above normal years. In addition, average salinities by water year type would not increase by five percent or more during any month or water year type (Appendix F5, 4 vs. 2, pg. 118).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would not differ from the CEQA No Project Alternative by ten percent or more. Salinities under the CEQA Modified Flow Alternative would be equal to or greater than five percent, relative to the CEQA No Project Alternative on one occasion in February of a wet year; and on occasion in January, two in February, and two in June of critical years. However, monthly average EC values under both alternatives would comply with D-1641 standards (Appendix F5, 4 vs. 2, pgs. 119 through 130).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-57**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Table 9-57. Differences in Monthly Mean Salinity (µS/cm) in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	531	610	701	602	533	614	706	605	2 (0%)	5 (1%)	5 (1%)	2 (0%)
1987	609	618	681	586	596	553	641	578	-13 (-2%)	-65 (-11%)	-40 (-6%)	-8 (-1%)
1990	612	774	641	572	608	768	651	578	-4 (-1%)	-6 (-1%)	10 (2%)	5 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.4-22: Salinity changes at Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Middle River at Victoria Canal is an indicator of central Delta water quality and the quality at Victoria Island agricultural siphons. There are no applicable EC objectives for Middle River at Victoria Canal noted in D-1641.

Long-term average salinities at Victoria Canal under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 1.3 percent lower in September to 1.4 percent higher in July. Average salinities by water year type would decrease by five percent or more (up to 6.5 percent) during September of above normal and below normal years. In addition, average salinities by water year type under the CEQA Modified Flow Alternative would not increase by five percent or more during any month or water year type (Appendix F5, 4 vs. 2, pg. 131).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would not differ from the CEQA No Project Alternative by ten percent or more during any of the 192 months modeled (Appendix F5, 4 vs. 2, pgs. 132 through 143). Salinities under the CEQA Modified Flow Alternative would be equal to or greater than five percent, relative to the CEQA No Project Alternative on two occasions in February of critical years.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-58**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Table 9-58. Differences in Monthly Mean Salinity (µS/cm) in Victoria Canal, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	396	467	558	467	398	471	563	469	1 (0%)	4 (1%)	5 (1%)	3 (1%)
1987	494	482	560	471	494	425	509	459	0 (0%)	-57 (-12%)	-52 (-9%)	-12 (-3%)
1990	450	612	532	405	448	603	543	410	-2 (0%)	-9 (-1%)	11 (2%)	5 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.4-23: Salinity changes at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns related to the City of Stockton's water supply intake.

Long-term average salinities at the Stockton Intake under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 1.6 percent lower in September to 1.9 percent higher in June. Average salinities by water year type would decrease by five percent or more (up to 8.1 percent) during September of below normal years and above normal years, and August of below normal years. In addition, average salinities by water year type under the CEQA Modified Flow Alternative would not increase by five percent or more during any month or water year type (Appendix F5, 4 vs. 2, pg. 144).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would be lower than the CEQA No Project Alternative by ten percent or more (10.5 percent) during 1 of the 192 months modeled, and would not be higher by ten percent or more during any of the 192 months modeled (Appendix F5, 4 vs. 2, pgs. 145 through 156). Salinities under the CEQA Modified Flow Alternative would be equal to or greater than five percent, relative to the CEQA No Project Alternative on one occasion in January; two in February; and one in June and July of critical years; as well as on one occasion in June dry years.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-59**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Table 9-59. Differences in Monthly Mean Salinity (µS/cm) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Salinity (µS/cm)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	358	423	503	358	360	428	508	360	2 (1%)	5 (1%)	5 (1%)	2 (1%)
1987	409	421	462	341	390	356	421	335	-19 (-5%)	-65 (-15%)	-41 (-9%)	-6 (-2%)
1990	444	543	433	303	439	541	442	305	-6 (-1%)	-2 (0%)	9 (2%)	2 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.4-24: Changes in chloride concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objective for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations at Highway 4 under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 2.9 percent lower in September to 4.7 percent higher in June (Appendix F5, 4 vs. 2, pg. 157). Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative would not exceed about 5 percent except during May of dry years and May, June, and July of critical years when they would be 5.5 percent, 8.0 percent, 6.4 percent, and 5.7 percent higher, respectively; as well as during August and September of above normal years and October, August, and September of below normal years when they would be 13.0 percent, 12.6 percent, 6.1 percent, 12.4 percent, 12.7 percent lower (Appendix F5, 4 vs. 2, pg. 158 through 169).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 30 of the 192 months modeled. During these 30 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 17 occasions and lower on 13 occasions compared to those under the CEQA No Project Alternative. Differences in monthly average chloride ion concentrations under the CEQA Modified Flow Alternative would be lower by ten percent or more (up to 16.1 percent) during 3 of the 192 months modeled and higher by ten percent or more (up to 42.1 percent) during 5 of the 192 months modeled (Appendix F5, 4 vs. 2, pg. 158 through 169). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-60**.

Table 9-60. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake) from October Through September Over the 16-year Simulation Period Under the CEQA Modified Flow Alternative and the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Modified Flow Alternative	127.9	102.6	102.5	87.8	66.5	44.5	37.0	42.6	47.4	56.2	96.3	128.5
CEQA No Project Alternative	129.3	102.8	102.0	86.3	64.8	44.2	36.9	41.2	45.3	54.8	98.7	132.3

Temporal patterns in chloride ion concentrations under the CEQA Modified Flow Alternative in the Delta are similar in nature to those previously discussed for salinity.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-61**).

Table 9-61. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	113	137	161	61	114	139	163	61	1 (1%)	2 (2%)	2 (1%)	1 (1%)
1987	142	135	139	45	133	99	76	43	-9 (-6%)	-36 (-26%)	-62 (-45%)	-2 (-4%)
1990	146	200	76	44	144	199	78	45	-2 (-2%)	-2 (-1%)	2 (3%)	1 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity..

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.4-25: Changes in chloride concentrations in CCWD Pumping Plant #1 (Rock Slough) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta.

The applicable chloride ion concentration objective under D-1641 for CCWD Pumping Plant #1 (Rock Slough) is 150 mg/l year-round.

Long-term average chloride ion concentrations at CCWD Pumping Plant #1 (Rock Slough) under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 3.0 percent lower in September to 5.4 percent higher in June. Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would not exceed about 5 percent except during June of dry years and June and July of critical years when they would be approximately 5 percent to approximately 8 percent higher, and August and September of above normal years and October, August, and September when they would be approximately 7 percent to 13 percent lower (Appendix F5, 4 vs. 2, pg. 170).

Over the entire 16-year simulation period, monthly average chloride concentrations would exceed 150 mg/l under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative during 44 of the 192 months modeled. During those 44 months when chloride ion concentrations exceeded 150 mg/l, concentrations would be higher under the CEQA Modified Flow Alternative by 0.1 percent to 3.1 percent on 18 occasions and lower by 0.1 percent to 12.9 percent on 21 occasions (Appendix F5, 4 vs. 2, pg. 171 through 182). There also would be 2 less occurrences under the CEQA Modified Flow Alternative when monthly mean chloride ion concentrations exceeded 150 mg/l. Monthly mean chloride ion concentrations from October through September are presented in **Table 9-62**.

Table 9-62. Monthly Mean Chloride Ion Concentrations (mg/l) CCWD Pumping Plant #1 (Rock Slough) from October Through September Over the 16-year Simulation Period Under the CEQA Modified Flow Alternative and the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Modified Flow Alternative	155.0	124.4	119.4	109.6	87.7	64.7	58.3	43.2	44.7	69.1	120.4	153.2
CEQA No Project Alternative	157.2	124.9	118.9	108.1	85.5	64.2	58.2	42.9	42.4	67.6	123.3	158.0

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-63**).

Table 9-63. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at CCWD Pumping Plant #1 (Rock Slough), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	113	135	147	90	114	137	149	91	1 (0%)	2 (1%)	2 (1%)	1 (1%)
1987	167	155	132	57	161	123	114	54	-5 (-3%)	-32 (-21%)	-18 (-14%)	-2 (-4%)
1990	158	185	108	61	157	184	110	61	-1 (-1%)	-1 (-1%)	2 (2%)	0 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.4-26: Changes in chloride concentrations in Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives for Old River at Rock Slough (CCWD Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations in Old River at Rock Slough under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 3.1 percent lower in September to 7.5 percent higher in June. Differences in average chloride ion concentration by water year type do not exceed 5 percent except during June of dry years and May and June of critical years when they would be approximately 8 percent to 9 percent higher, and during July, August, and September of above normal and below normal years and October of below normal years when they would be 6 percent to 15 percent lower under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F5, 4 vs. 2, pg. 183).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 33 of the 192 months modeled. During these 33 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 19 occasions and lower on 14 occasions, relative to the CEQA No Project Alternative. Differences in monthly average chloride ion concentrations under the CEQA Modified Flow Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 19.9 percent) during 7 of the 192 months modeled and higher by ten percent or more (up to 37.3 percent) during 6 of the 192 months modeled (Appendix F5, 4 vs. 2, pg. 184 through 195). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-64.**

Table 9-64. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Rock Slough (CCWD Intake) from October Through September Over the 16-year Simulation Period Under the CEQA Modified Flow Alternative and the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
CEQA Modified Flow Alternative	146.4	112.6	114.4	90.5	61.6	35.7	28.8	32.0	33.1	63.9	122.4	161.0
CEQA No Project Alternative	144.0	112.2	114.9	92.5	63.2	36.0	28.8	33.2	35.6	64.7	118.5	155.8

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-65**).

Table 9-65. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Rock Slough (CCWD Intake), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	**CEQA No Project Alternative**				**CEQA Modified Flow Alternative**				**Absolute Difference (Relative Difference)[a]**			
	Dec	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	135	158	177	57	136	161	180	58	2 (1%)	3 (2%)	3 (1%)	1 (1%)
1987	165	153	140	32	149	109	77	31	-16 (-10%)	-44 (-29%)	-63 (-45%)	-1 (-4%)
1990	182	224	73	37	178	224	75	37	-3 (-2%)	0 (0%)	2 (3%)	0 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.4-27: Changes in chloride concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 2.9 percent lower in September to 2.6 percent higher in July. Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would not exceed about 5 percent except during May and July of critical years when they would be 5.2 percent and 5.8 percent higher; and during August and September of above normal years and October, August, and September of below normal years when they would be 9.2 percent, 11.5 percent, 6.0 percent, 10.2 percent and 12.0 percent lower (Appendix F5, 4 vs. 2, pg. 196).

Over the entire 16-year simulation period, monthly mean chloride concentrations would not exceed 250 mg/l under either the CEQA Modified Flow Alternative or the CEQA No Project Alternative. However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 18 of the 192 months modeled. During these 18 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 8 occasions and lower on 10 occasions. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 6 of the 192 months modeled, and would be higher on 1 (up to 28.9 percent) occasion and lower on 5 (up to 18.0 percent) occasions under the CEQA Modified Flow Alternative (Appendix F5, 4 vs. 2, pg. 197 through 208). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-66.**

Table 9-66. Monthly Mean Chloride Ion Concentrations (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant) from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA No Project Alternative

	Monthly Mean Chloride Ion Concentration (mg/l)											
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
CEQA Modified Flow Alternative	101.0	86.8	82.8	74.6	58.2	44.9	38.8	41.1	47.2	46.9	70.5	96.3
CEQA No Project Alternative	102.1	87.0	82.5	73.8	56.8	44.9	38.7	40.2	46.9	45.7	72.0	99.2

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-67**).

Table 9-67. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	85	105	128	64	86	107	130	65	1 (1%)	2 (2%)	2 (1%)	1 (1%)
1987	110	107	121	59	108	85	75	57	-2 (-2%)	-22 (-21%)	-46 (-38%)	-2 (-4%)
1990	103	156	79	50	102	154	81	51	-1 (-1%)	-2 (-1%)	2 (3%)	1 (2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.4-28: Changes in chloride concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 250 mg/l year round.

Long-term average chloride ion concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 2.0 percent lower in September to 2.7 percent higher in June. Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would not exceed approximately 5 percent except during May and July of critical years when they would be 6.2 percent and 5.9 percent higher; and in August and September of above normal and October, August, and September of below normal year when they would be 7.0 percent, 8.2 percent, 5.4 percent, 8.9 percent, and 9.6 percent lower (Appendix F5, 4 vs. 2, pg. 209).

Over the entire 16-year simulation period, monthly mean chloride concentrations would not exceed 250 mg/l under either the CEQA Modified Flow Alternative or the CEQA No Project Alternative. However, differences in chloride ion concentrations equal to or greater than 5 percent occurred during 17 of the 192 months modeled. During these 17 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 8 occasions and lower on 9 occasions, relative to the CEQA No Project Alternative. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 4 of the 192 months modeled, and would be higher (up to 32.4 percent) on 2 occasions and lower (up to 13.4 percent) on 2 occasions under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F5, 4 vs. 2, pg. 210 through 221). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-68**.

Table 9-68. Monthly Mean Chloride Ion Concentrations (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) from October Through September Over the 16-year Simulation Period Under the CEQA Accord Alternative and the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Modified Flow Alternative	101.6	86.8	87.6	79.5	67.6	60.2	45.6	43.7	54.5	55.3	82.5	110.7
CEQA No Project Alternative	102.6	86.9	87.4	78.9	66.6	60.0	45.6	42.6	53.1	54.2	83.8	112.9

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling has shown impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-69**).

Table 9-69. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	92	111	134	78	93	113	135	79	0 (1%)	1 (1%)	1 (1%)	0 (0%)
1987	111	113	129	76	108	97	84	75	-3 (-3%)	-16 (-14%)	-45 (-35%)	-1 (-2%)
1990	112	152	84	74	111	150	86	75	-1 (-1%)	-1 (-1%)	1 (2%)	1 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.4-29: Changes in chloride concentrations in Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives in Middle River at Victoria Canal noted in D-1641. However, Middle River at Victoria Canal is an indicator of central Delta water quality and water quality at the Victoria Island agricultural siphons, and is therefore evaluated here.

Long-term average chloride ion concentrations in Middle River at Victoria Canal under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 2.0 percent lower in September to 2.8 percent higher in July. Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would not exceed approximately 5 percent except during May and July of critical years when they would be 6.6 percent and 6.4 percent higher;

and during August and September of above normal and below normal years when they would be 5.2 percent, 8.2 percent, 7.3 percent, and 9.7 percent lower (Appendix F5, 4 vs. 2, pg. 222).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 18 of the 192 months modeled. During these 18 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 11 occasions and lower on 7 occasions, relative to the CEQA No Project Alternative. Differences in monthly average chloride ion concentrations under the CEQA Modified Flow Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 13.2 percent) during 2 of the 192 months modeled and higher by 34.1 percent during 1 of the 192 months modeled (Appendix F5, 4 vs. 2, pg. 223 through 234). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-70**.

Table 9-70. Monthly Mean Chloride Ion Concentrations (mg/l) in Middle River at Victoria Canal from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Modified Flow Alternative	76.3	70.2	63.4	62.3	55.1	46.0	41.7	48.8	55.0	40.0	50.4	67.2
CEQA No Project Alternative	76.8	70.3	63.2	61.9	54.1	45.8	41.6	47.5	53.9	38.9	51.0	68.6

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-71**).

Table 9-71. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Middle River at Victoria Canal, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	59	76	98	58	59	77	99	58	0 (1%)	1 (1%)	1 (1%)	0 (1%)
1987	82	80	99	59	83	66	64	57	0 (0%)	-14 (-18%)	-34 (-35%)	-2 (-3%)
1990	72	111	68	49	71	109	69	49	0 (-1%)	-2 (-2%)	2 (2%)	1 (2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Impact 9.2.4-30: Changes in chloride concentrations at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives at the Stockton Intake noted in D-1641. However this location is evaluated to address potential concerns related to the City of Stockton's water supply intake.

Long-term average chloride ion concentrations at the Stockton Intake under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would range from 2.7 percent lower in September to 4.1 percent higher in June. Differences in average chloride ion concentration by water year type would not exceed approximately 5 percent except during May, June, and July of critical years when they would be 6.6 percent, 6.7 percent, and 5.7 percent higher and August and September of above normal and below normal years when they would be 12.7 percent, 11.8 percent, 12.8 percent, and 13.0 percent lower (Appendix F5, 4 vs. 2, pg. 235).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occurred during 22 of the 192 months modeled. During these 22 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 13 occasions and lower on 9 occasions, relative to the CEQA No Project Alternative. Differences in monthly mean chloride ion concentrations under the CEQA Modified Flow Alternative would be lower than the CEQA No Project Alternative by ten percent or more (up to 18.2 percent) during 6 of the 192 months modeled and higher by ten percent or more (up to 32.9 percent) during 3 of the 192 months modeled (Appendix F5, 4 vs. 2, pgs. 236 through 247). Monthly mean chloride ion concentrations from October through September are presented in Table 9-72.

Table 9-72. Monthly Mean Chloride Ion Concentrations (mg/l) at the Stockton Intake from October Through September Over the 16-year Simulation Period Under the CEQA Modified Flow Alternative and the CEQA No Project Alternative

	Monthly Mean Chloride Ion Concentration (mg/l)											
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
CEQA Modified Flow Alternative	57.8	50.5	46.1	45.7	39.6	32.2	36.4	45.3	33.0	26.8	38.2	50.3
CEQA No Project Alternative	58.1	50.5	45.9	44.9	38.8	32.1	36.4	44.0	31.7	26.3	39.1	51.8

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA No Project Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-73**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to a level that would not unreasonably affect Delta water quality.

Table 9-73. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA No Project Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA No Project Alternative				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	49	65	85	42	50	66	86	42	1 (1%)	1 (2%)	1 (1%)	0 (1%)
1987	62	65	75	39	57	49	51	38	-5 (-7%)	-16 (-25%)	-24 (-32%)	-1 (-2%)
1990	70	95	53	33	69	94	54	34	-1 (-2%)	0 (-1%)	1 (2%)	0 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.4-31: Changes in DOC concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no DOC objectives noted in D-1641 for any location within the Delta. However, consideration of data regarding the average DOC concentrations in the Delta, assumed levels of natural variation, and assumed relationships between DOC concentrations and THM formation in drinking water has resulted in establishment of a monthly change significance criterion for DOC of 0.4 mg/l (see Section 9.2.2.1).

Long-term average DOC concentrations at Highway 4 under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA No Project Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not exceed 0.1 mg/l (Appendix F5, 4 vs. 2, pg. 248). Monthly average DOC concentrations also would be similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 4 vs. 2, pgs. 249 through 260). Therefore, implementation of the CEQA Modified Flow Alternative would not unreasonably affect Delta water quality.

Impact 9.2.4-32: Changes in DOC concentrations in Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations in the Old River at Rock Slough under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA No Project Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the CEQA Modified Flow Alternative would not exceed 0.1 mg/l (Appendix F5, 4 vs. 2, pg. 261). Monthly average DOC concentrations also would be similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 4 vs. 2, pgs. 262 through 273). Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-33: Changes in DOC concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations at Clifton Court Forebay under the CEQA Modified Flow Alternative remain essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA No

Project Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, do not exceed 0.1 mg/l (Appendix F5, 4 vs. 2, pg. 274). Monthly average DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 4 vs. 2, pgs. 275 through 286). Consequently, changes in the monthly average DOC concentrations do not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-34: Changes in DOC concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average DOC concentrations at Jones Pumping Plant under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA No Project Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the CEQA Modified Flow Alternative would not exceed 0.1 mg/l (Appendix F5, 4 vs. 2, pg. 287). Monthly average DOC concentrations also would be similar under each alternative, with a maximum absolute change of 0.1 mg/l (Appendix F5, 4 vs. 2, pgs. 288 through 299). Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-35: Changes in monthly mean flows in the Old River at Bacon Island that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Old River at Bacon Island under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would be essentially equivalent except during June and July during which they would be 1 percent to 6 percent higher, relative to the CEQA No Project Alternative over the 16-year simulation period. The direction of flow under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative moves towards the Delta pumps during all months and water years except during February through April of wet years. The magnitude to flows moving towards Delta pumps during February through May of all water years would be essentially equivalent during all months and water years under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F5, 4 vs. 2, pg. 300). In general, the magnitude of flows moving towards Delta pumps from June through January during all years is slightly higher under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F5, 4 vs. 2, pgs. 301 through 312).

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 40 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 150 months (Appendix F5, 3 vs. 2, pg. 301 through 312).

Overall, potential changes in monthly mean flows under the CEQA Modified Flow Alternative, compared to the CEQA No Project Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-36: Changes in monthly mean flows in the Middle River at Middle River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Middle River at Middle River under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative do not exceed about 3 percent over the 16-year simulation period. The direction of flow under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative moves towards the Delta pumps during all months and water years. The magnitude of flows moving towards Delta pumps under the CEQA Modified Flow Alternative during February through May would be reduced, and would be essentially equivalent, relative to the CEQA No Project Alternative during all months and water years (Appendix F5, 4 vs. 2, pg. 313). In general, the magnitude of flows moving towards Delta pumps under the CEQA Modified Flow Alternative is up to 106 cfs during some months and water years, relative to the CEQA No Project Alternative (Appendix F5, 4 vs. 2, pgs. 314 through 325).

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 39 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 153 months (Appendix F5, 3 vs. 2, pg. 314 through 325).

Overall, potential changes in monthly mean flows under the CEQA Modified Flow Alternative, compared to the CEQA No Project Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Delta water quality.

Impact 9.2.4-37: Changes in monthly mean flows in the Middle River at Mowry Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Middle River at Mowry Bridge would be essentially equivalent under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative over the 16-year simulation period. The direction of flow under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative moves away from the Delta pumps and would be essentially equivalent during all months and water years under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F5, 4 vs. 2, pgs. 326). Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably Delta water quality.

Impact 9.2.4-38: Decreases in San Luis Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Historically, the CVP and SWP have cooperated to try to maintain San Luis Reservoir above 300 TAF in response to the low-point problem and thus, avoid adverse impacts to water quality. Long-term average monthly combined CVP and SWP reservoir storage and average monthly reservoir storage by water year type under the CEQA Modified Flow Alternative would be essentially equivalent in San Luis Reservoir, relative to the CEQA No Project Alternative over the 72-year simulation period (Appendix F4, 4 vs. 2, pg. 1339 and 1376). In addition, there would be no additional months under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, when combined CVP and SWP monthly mean reservoir storage drops below 300 TAF (Appendix F4, 4 vs. 2, pg. 1339 and 1376 and 1377 through 1388).

Therefore, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect water quality in San Luis Reservoir.

9.2.5 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE CEQA YUBA ACCORD ALTERNATIVE COMPARED TO THE CEQA EXISTING CONDITION

Water quality impacts that could be expected to occur as a result of changes in the operation of the Yuba Project and CVP/SWP facilities, and associated hydrologic changes, are evaluated below.

Impact 9.2.5-1: Decreases in New Bullards Bar Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year simulation period, differences in long-term average end-of-month storage and end-of-month storage by water year type under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would not exceed 5 percent except during critical years when reservoir storage would be up to 18 percent lower in September under the CEQA Yuba Accord Alternative (Appendix F4, 3 vs. 1, pg. 1). During most months (i.e., August, September, October, and November) and water years when reservoir storage volumes are typically lowest due to reservoir storage releases occurring from July through September, average differences in monthly mean storage would range from about 2 percent lower in August to about 3 percent lower in October and November under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition. Under the CEQA Yuba Accord Alternative, storage would be essentially equivalent[27] or higher at least 50 percent of the time over the monthly cumulative distributions for all months of the year. During periods exhibiting the lowest storage conditions[28] in October and November, storage would be about 20 percent lower nearly all of the time under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition.

Generally, a greater volume of water present in the reservoir equates to a greater amount of dilution regarding any constituent of concern that may be present in the water. However, the magnitude and frequency (i.e., up to 20 percent lower 25 percent of the time during October and November) of the changes in reservoir storage levels simulated under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would not be likely to cause metals and other constituents of concern that may be concentrated in the sediments at the bottom of the reservoir to be re-suspended and degrade long-term water quality. In addition, decreases in water quality in New Bullards Bar due to increases in water temperature are unlikely to occur due to its steep-sided conical shape, which creates sufficient water depths to maintain a large cold pool reservoir under all operational reservoir levels throughout the year.

As a result of the water transfers occurring from July through September under the CEQA Yuba Accord Alternative, large reductions in New Bullards Bar Reservoir storage would be expected to occur during the late summer and fall. However, the frequency and magnitude of these reductions in storage would not be sufficient to reduce the long-term water quality in New Bullards Bar Reservoir due to the morphology of the reservoir. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in less than significant impacts to water quality in New Bullards Bar Reservoir.

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[27]Essentially equivalent refers to relative differences in storage volume between the alternative and the basis of comparison that is less than or equal to 1 percent (See Section 9.2.1).

[28] The lowest 25 percent of the storage cumulative probability distribution.

Impact 9.2.5-2: Changes in monthly mean flows in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

During the seasonal high flow period (i.e., December through June), long-term average flows in the lower Yuba River at Smartville would range from essentially equivalent in December, January and May to approximately 4 percent lower in March under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 100). During the seasonal low flow period (i.e., August, September, October, and November), long-term average flows in the lower Yuba River at Smartville would range from approximately 3 percent lower in August to approximately 8 percent higher in November under the CEQA Yuba Accord Alternative. Maximum decreases in mean monthly flow under the CEQA Yuba Accord Alternative would range from about 15 percent to 17 percent and occur during July and August of above normal years. During critical years, flows would be generally higher by about 2 percent to about 27 percent, compared to those under the CEQA Existing Condition. During typically low flow conditions (i.e., lowest 25 percent of the monthly cumulative flow distribution) occurring from August through November, flows under the CEQA Yuba Accord Alternative would be on average about 15 percent to 55 percent higher about 85 percent to 100 percent of the time (Appendix F4, 3 vs. 1, pg. 125 through 136).

During the seasonal high flow period[29], long-term average flows in the lower Yuba River at Marysville would range from essentially equivalent[30] in December, January and April to approximately 4 percent lower in March, and 5 percent higher in June under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 272). During the seasonal low flow period[31], long-term average flows in the lower Yuba River would range from approximately 10 percent lower in August to approximately 8 percent higher in November under the CEQA Yuba Accord Alternative. Maximum decreases flow under the CEQA Yuba Accord Alternative would range from about 31 percent to 33 percent, and occur during July and August of above normal water years. During critical water years, flows under the CEQA Yuba Accord Alternative would be generally higher by about 2 percent to about 80 percent, compared to those under the CEQA Existing Condition. During low flow conditions occurring from August through November, flows under the CEQA Yuba Accord Alternative are on average about 20 percent to 100 percent higher about 60 percent to 100 percent of the time compared those under to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 297 through 308).

Overall, lower Yuba River flows under the CEQA Yuba Accord Alternative would be higher than flows under the CEQA Existing Condition. Increased lower Yuba River flows would allow dilution of water quality constituents, including pesticides and fertilizers from agricultural runoff, potentially having a beneficial effect on water quality. Changes in the frequency and magnitude of flows in the lower Yuba River would not result in any long-term impacts to designated beneficial uses, existing regulatory standards, degradation of general water quality. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Yuba River.

[29] Generally, December through June in the lower Yuba River.

[30] Essentially equivalent refers to relative differences in flow between the alternative and the basis of comparison that are less than or equal to 1 percent (See Section 9.2.1).

[31] Generally, ranging from August through November in the lower Yuba River.

Impact 9.2.5-3: Changes in monthly mean water temperatures in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average water temperatures in the lower Yuba River at Smartville under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, are essentially equivalent[32] during all months (Appendix F4, 3 vs. 1, pg. 174). Long-term average water temperatures at Marysville are essentially equivalent during most months, but would increase (0.9° F) in July and would decrease (up to 0.7°F) in June and September under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 346). Long-term average monthly water temperatures and average monthly water temperatures by water year in the lower Yuba River would not exceed 65°F under the CEQA Yuba Accord Alternative.

Under the CEQA Yuba Accord Alternative, long-term average water temperatures at Daguerre Point Dam during the April through July rice field flooding and planting period are essentially equivalent during most months, and would increase slightly (0.4°F) in July compared to those under the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 223). However, water temperatures during these months would not exceed about 59°F under either alternative. For all water years, average monthly water temperatures at Daguerre Point Dam would be essentially equivalent during most months under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, and would remain below 60°F under both alternatives. Over the 72-year simulation period, there is one occurrence when monthly mean water temperatures in July would exceed 65°F by approximately 5°F (Appendix F4, 3 vs. 1, pg. 248 through 259).

Overall, lower Yuba River water temperatures under the CEQA Yuba Accord Alternative would be similar to the CEQA Existing Condition. Water temperature changes occurring in the lower Yuba River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Yuba River.

Impact 9.2.5-4: Decreases in Oroville Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average end-of-month Oroville Reservoir storage would be essentially equivalent under the CEQA Yuba Accord Alternative and the CEQA Existing Condition (Appendix F4, 3 vs. 1 pg. 406). Differences in average end-of-month storage under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would not exceed 1 percent in any water year. During all months, the cumulative reservoir storage distributions are essentially equivalent or higher over 90 percent of the time, under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition (Appendix F4, 3 vs. 1 pg. 431 through 442). Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would have a less than significant impact on water quality in Oroville Reservoir.

[32] Essentially equivalent refers to relative differences in water temperatures between the alternative and the basis of comparison that are less than or equal to 0.3 °F (See Section 9.2.1).

Impact 9.2.5-5: Changes in monthly mean flows in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly flows or average monthly flows by water year type in the Feather River below the Fish Barrier Dam under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition.

Long-term average monthly flows in the Feather River below the Thermalito Afterbay Outlet would be about 3 percent lower in June and about 1 percent lower in September and November under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, and essentially equivalent or up to about 3 percent higher during all other months over the 72-year simulation period (Appendix F4, 3 v. 1. pg. 603). Differences in long-term average monthly flows in the Feather River at the mouth under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would not exceed approximately 2 percent (Appendix F4, 3 v. 1. pg. 775). Decreases in average monthly flow below the Thermalito Afterbay Outlet and at the mouth of the Feather River would range from 1 percent lower to approximately 7 percent lower during all water years. In addition, during July, August, September, and October of critical years, flows would be up to 12 percent higher under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition.

During low flow conditions occurring from September through November, flows below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be essentially equivalent about 60 to 85 percent of the time, and higher about 40 percent to 15 percent of the time (Appendix F4, 3 v. 1. pg. 628 through 639). During low flow conditions at the mouth of the Feather River, flows under the CEQA Yuba Accord Alternative would be essentially equivalent about 25 percent to 75 percent of the time, and higher about 55 percent to 20 percent of the time (Appendix F4, 3 v. 1. pg. 800 through 811).

Overall, lower Feather River flows under the CEQA Yuba Accord Alternative would not substantially change compared to those under the CEQA Existing Condition and, thus, would not be expected to degrade water quality or adversely affect beneficial uses. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Feather River.

Impact 9.2.5-6: Changes in monthly mean water temperatures in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type in the lower Feather River below the Fish Barrier Dam, below the Thermalito Afterbay Outlet and at the mouth would be essentially equivalent under the CEQA Yuba Accord Alternative and the CEQA Existing Condition, except during June of above normal years, and July of wet years at the mouth when they would be 0.4ºF higher below the Thermalito Afterbay Outlet (Appendix F4, 3 vs. 1, pg. 677). Average monthly water temperatures under the CEQA Yuba Accord Alternative during these times months would not exceed approximately 72ºF.

Monthly mean water temperatures below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be essentially equivalent to the CEQA Existing Condition about 95 percent to 100 percent of the time during all months (Appendix F4, 3 v. 1. pg. 628 through 639). At the mouth of the Feather River, water temperatures would be essentially equivalent over the cumulative water temperature distribution about 95 percent to 100 percent of the time during all months, excluding May and August (Appendix F4, 3 v. 1. pg. 849 through 860). During May, water temperatures are essentially equivalent about 90 percent of the time and lower by an average of 0.5ºF about 10 percent of the time. During the highest 25 percent of the cumulative water temperature distribution (i.e., highest 25 percent of water temperatures), water temperatures in May under the CEQA Yuba Accord Alternative would be on average 0.5ºF lower about 40 percent of the time and would be essentially equivalent, or slightly higher (not exceeding 70ºF) for the remainder of the distribution. During July, water temperatures under the CEQA Yuba Accord Alternative are essentially equivalent about 90 percent of the time, and slightly lower and higher (not exceeding 77.6ºF) by about 0.4ºF 10 percent of the time over the cumulative water temperature distribution, compared to the CEQA Existing Condition.

Overall, lower Feather River water temperatures under the CEQA Yuba Accord Alternative would be similar to the CEQA Existing Condition. Water temperature changes occurring in the lower Feather River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Feather River.

Impact 9.2.5-7: Changes in monthly mean flows in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Sacramento River below the confluence with the Feather River (Appendix F4, 3 vs. 1, pg. 882) and at Freeport (Appendix F4, 3 vs. 1, pg. 1005) under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would be essentially equivalent during all months over the 72-year simulation period. During all water years, differences in average monthly flow below the Feather River confluence and at Freeport also would not exceed approximately 4 percent. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than a significant impact on water quality in the Sacramento River.

Impact 9.2.5-8: Changes in monthly mean water temperatures in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Average monthly water temperatures by water year type under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, in the Sacramento River below the Feather River confluence (Appendix F4, 3 vs. 1, pg. 956) and at Freeport (Appendix F4, 3 vs. 1, pg. 1054) would be essentially equivalent. Water temperatures below the Feather River confluence (Appendix F4, 3 vs. 1, pg. 907 through 918) and at Freeport (Appendix F4, 3 vs. 1, pg. 1079 through 1090) under the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be essentially equivalent approximately 100 percent of the time over the cumulative water temperature distribution during all months. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would have a less than a significant impact on water quality in the Sacramento River.

Impact 9.2.5-9: Changes to the monthly mean location of X2 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The location of the estuarine salinity gradient is regulated during the months of February through June by the location of X2 objective in the 1995 WQCP (D-1641). The X2 location must remain downstream of the Confluence of the Sacramento and San Joaquin rivers[33] (River Kilometer 81, located upstream from the Golden Gate Bridge) for the entire 5-month period. The X2 objective also specifies the number of days each month that that location of X2 must be

[33] Also referred to as Collinsville.

downstream of Chipps Island (RK 74) or downstream of Roe Island[34] (RK 64). However, due to DSM2 modeling limitations these two locations are not evaluated (see Section 9.2.1.2)

The long-term average monthly mean X2 location from February through June under the CEQA Yuba Accord Alternative and the CEQA Existing Condition are presented in **Table 9-74**. During all months of the year, the long-term average and average location of X2 by water year type would remain essentially equivalent (i.e., relative change less than 1 percent) under CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition. Additionally, the CEQA Yuba Accord Alternative would result in one less occurrence when the monthly mean X2 location is upstream of the Confluence (RK 81) in February compared to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 1214 through 1225).

Table 9-74. Long-term Average Monthly Mean X2 Location (RK) from February Through June Under the CEQA Yuba Accord Alternative and the CEQA Existing Condition.

Long-term Average[a] Monthly Mean X2 Location (RK)					
Alternative	Feb	Mar	Apr	May	Jun
CEQA Yuba Accord Alternative	71.5	66.5	66.0	67.9	70.1
CEQA Existing Condition	71.5	66.5	66.0	67.9	70.1
[a] Over the 72-year simulation period					

Delta outflow objectives established in SWRCB D-1641 extend throughout the year. For the February though June period under the CEQA Yuba Accord Alternative, Delta outflow objectives are met by compliance with the X2 objective. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Overall, simulated changes in the monthly mean X2 location under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would not be of sufficient magnitude or frequency to adversely impact water quality resources in the Delta. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.5-10: Changes to monthly mean Delta outflow that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

As described above, Delta outflow objectives established in SWRCB D-1641 extend throughout the year and are met by compliance with the X2 objective during the February though June period. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Over the entire 72-year period of simulated October through September outflows, long-term average Delta outflow would be essentially equivalent under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition. Average monthly outflows by water year type under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition meet minimum outflow requirements, as defined in the SWRCB D-1641. Average monthly outflow differences under the CEQA Yuba Accord Alternative and the CEQA Existing Condition would not exceed 2 percent. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.5-11: Changes to monthly mean E/I ratios that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The Delta E/I ratio limits, established in SWRCB D-1641, specify that up to 35 percent of Delta inflows may be exported during the February through June period, and up to 65 percent of

[34] Also referred to as the Port Chicago EC monitoring station.

Delta inflows may be exported during the remaining months (i.e., July through January). These limits are consistently met under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition. In addition, differences in average monthly E/I ratios between the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be essentially equivalent during most months, and differences that do occur would not exceed 3 percent over the 72-year simulation period. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.5-12: Salinity changes in the Sacramento River at Emmaton that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Emmaton during the April through August period range from 450 to 2,780 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Emmaton under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would range from 3.7 percent lower in July to 1.5 percent higher in January (Appendix F5, 3 vs. 1, pg. 1). Average salinities by water year type would decrease by five percent or more (6.7 percent) during July of critical years. In addition, average salinities by water year type would increase by five percent or more (up to 5.8 percent) during January of wet and dry years.

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 12.4 percent) during 4 of the 192 months modeled, and higher by ten percent or more (up to 14.9 percent) during 2 of the 192 months modeled (Appendix F5, 3 vs. 1, pg. 2 through 13). As a result of the decreases in monthly average salinities under the CEQA Yuba Accord Alternative, modeled EC values between April and August would be in compliance with D-1641 standards 1 additional time (1 critical year in August), compared to the CEQA Existing Condition. In addition, during the 12 months when neither the alternative nor the basis of comparison is compliant with D-1641 standards, EC conditions would measurably improve (by up to 11.0 percent) under the CEQA Yuba Accord Alternative during 4 months, and measurably decline (by up to 6.0 percent) during 5 months.

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, generally would occur during dry and critical years (**Table 9-75**). During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in salinity exhibited in the January and February output.

Table 9-75. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

	Salinity Change (µS/cm)		
Water Year	Increases ≥ 5% (range)	% Difference (range)	Month(s) and Number of Occurrences[a]
Wet	350-941	8-9	Jan (2)
Above Normal	140	6	Oct (1)
Below Normal	---	---	---
Dry	177-1,621	5-15	Oct (1), Dec(1), Jan(1), Feb(1), Mar(1), May (1), Jul (1), Aug(2)
Critical	1,225-3,143	5	Jan (1), Aug(1)

[a] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent.

While simplifying assumptions are required to model the system, those simplifying assumptions may require more refined analysis for specific instances when modeling output appears to be non-representative of anticipated operations. The refill related impacts described above are an example of one of these instances; through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that refill-related impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-76**).

Table 9-76 Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

	Monthly Mean Salinity (µS/cm)											
Year	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,073	1,195	887	410	1,073	1,255	916	414	0 (0%)	60 (5%)	29 (3%)	4 (1%)
1987	1,964	1,210	455	188	2,036	1,257	460	189	72 (4%)	47 (4%)	4 (1%)	0 (0%)
1990	1,828	932	424	544	1,808	953	436	548	-20 (-1%)	21 (2%)	12 (3%)	4 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-13: Salinity changes in the San Joaquin River at Jersey Point that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Jersey Point during the April through August period range from 450 to 2,200 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location. Long-term average salinities at Jersey Point under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would range from 2.6 percent lower in July to 2.6 percent higher in January Appendix F5, 3 vs. 1, pg. 14). Average salinities by water year type would decrease by five percent or more (up to 7.9 percent) during July and August of critical years and would increase by five percent or more (up to 6.0 percent) during January of wet and dry years, and July of dry years.

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative are lower than the CEQA Existing Condition by ten percent or more (up to 18.1 percent) during 4 of the 192 months modeled, and higher by ten percent or more (up to 16.0 percent) during 4 of the 192 months modeled (Appendix F5, 3 vs. 1, pg. 15 through 26). As a result of the decreases in monthly average salinities under the CEQA Yuba Accord Alternative, modeled EC values between April and August are in compliance with D-1641 standards during 1 additional month (1 critical year in July), compared to the CEQA Existing Condition. During the 21 months when neither the alterative nor the basis of comparison is compliant with D-1641 salinity standards, EC conditions would measurably improve (by up to 7.2 percent) under the CEQA Yuba Accord Alternative during 7 months, and measurably decline (by up to 15.0 percent) during 7 months.

Increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, generally occur during dry and critical years (**Table 9-77**).

Table 9-77. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Salinity Changes (µS/cm)			
Water Year Type	Increases ≥ 5%(range)	% Difference (range)	Month(s) and Number of Occurrences[a]
Wet	453 - 1,545	6 - 8	Jan (2), Feb (1)
Above Normal	---	---	---
Below Normal	---	---	---
Dry	944 – 2,350	8 - 15	Dec (1), Jan (1), Feb (1), Jul (2), Aug (2)
Critical	2,357	6	Aug (1)

[a] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-78**).

Table 9-78. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
Year	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[1]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,755	1,754	1,536	785	1,756	1,816	1,598	796	0 (0%)	62 (4%)	62 (4%)	11 (1%)
1987	1,796	1,611	931	276	1,906	1,688	944	277	110 (6%)	77 (5%)	13 (1%)	2 (1%)
1990	2,475	1,919	843	552	2,496	2,006	880	556	20 (1%)	87 (5%)	37 (4%)	5 (1%)

[a1] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-14: Salinity changes in the San Joaquin River at Airport Way Bridge (Vernalis) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Airport Way Bridge (Vernalis) are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period. Long-term average salinities and average salinities by water year type under the CEQA Yuba Accord Alternative indicate no change in EC values, compared to the CEQA Existing Condition (Appendix F5, 3 vs. 1, pg. 27). Similarly, monthly mean salinities are also identical under each alternative, and consequently do not indicate changes in the ability to meet D-1641 compliance standards (Appendix F5, 3 vs. 1, pg. 28 through 39). Therefore, implementation of the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact on salinity at Vernalis.

Impact 9.2.5-15: Salinity changes in the San Joaquin River at Brandt Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Brandt Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the Yuba Accord Alternative would have only negligible changes in EC values (i.e., up to 0.2 percent), compared to those under the CEQA Existing Condition (Appendix F5, 3 vs. 1, pg. 40). Monthly mean salinities also would remain similar under each alternative, with only 14 of the 192 months modeled indicating any difference and a maximum compared change of 0.9 percent (Appendix F5, 3 vs. 1, pg. 41 through 52). Consequently, monthly average salinities do not indicate changes in the ability to meet D-1641 compliance standards. Therefore, implementation of the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.5-16: Salinity changes in Middle River near Old River that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Middle River near Old River are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the CEQA Yuba Accord Alternative would have only negligible changes (up to 0.6 percent) in EC values, compared to those under the CEQA Existing Condition (Appendix F5, 3 vs. 1, pg. 53). Monthly mean salinities also would remain similar under each alternative, with a maximum compared change of 2.6 percent (Appendix F5, 3 vs. 1, pg. 54 through 65). Consequently, monthly average salinities do not indicate changes in the ability to meet D-1641 compliance standards. Therefore, implementation of the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.5-17: Salinity changes in Old River at Tracy Road Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Old River at Tracy Road Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities under the CEQA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 1.0 percent change) to the CEQA Existing Condition during all months of the year. In addition, changes in average salinities by water year type under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, do not exceed 1.0 percent (Appendix F5, 3 vs. 1, pg. 66). Monthly mean salinities also would remain similar under each alternative, with a maximum compared change of 3.5 percent (Appendix F5, 3 vs. 1, pg. 66). Consequently, monthly mean salinities do not indicate changes in the ability to meet D-1641 compliance standards (Appendix F5, 3 vs. 1, pg. 67 through 78). Therefore, implementation of the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact Delta water quality.

Impact 9.2.5-18: Salinity changes in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641. However this location is evaluated to address potential concerns related to the CCWD's water supply intake and potential impacts to water supplies associated with Los Vaqueros Reservoir.

Long-term average salinities at Highway 4 under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 2.3 percent lower in August to 1.6 percent higher in February. Average salinities by water year type would decrease by five percent or more (up to 8.6 percent) during July and August of critical years. In addition, average salinities by water year type would increase by five percent or more (5.8 percent) during August of dry years (Appendix F5, 3 vs. 1, pg. 79).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 18.7 percent) during 3 of the 192 months modeled, and higher by ten percent or more (up to 16.1 percent) during 3 of the 192 months modeled (Appendix F5, 3 vs. 1, pg. 80 through 91).

Increases in salinity equal to or greater than five percent over the 16-year simulation period under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition generally occur during dry and critical years (**Table 9-79**).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-80**).

Table 9-79. Differences in Monthly Mean Salinity (µS/cm) in the Old River at Highway 4 (Los Vaqueros Intake), by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

	Salinity Changes (µS/cm)		
Water Year Type	Increases ≥ 5% (range)	% Difference (range)	Month(s) and Number of Occurrences[a]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	493 - 705	8 - 16	Jan (1), Jul (1), Aug (2)
Critical	663 - 846	6	Feb (1), Aug (1)

[a] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent

Table 9-80. Differences in Monthly Mean Salinity (µS/cm) in Old River at Highway 4 (CCWD Los Vaqueros Intake), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

	Monthly Mean Salinity (µS/cm)											
	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	575	654	717	477	576	664	748	488	1 (0%)	10 (2%)	30 (4%)	10 (2%)
1987	646	573	629	375	662	608	644	379	16 (2%)	35 (6%)	15 (2%)	4 (1%)
1990	679	889	629	389	685	921	663	397	6 (1%)	31 (4%)	35 (6%)	8 (2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on salinities Delta water quality.

Impact 9.2.5-19: Salinity changes at CCWD Pumping Plant #1 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Sources of chlorides in Rock Slough include seawater, which intrudes into the Delta when freshwater outflow from the Delta is low, local drainage and seepage from adjacent lands, and the Sacramento and San Joaquin rivers. Seawater and local drainage are the primary concerns (DWR 2003b). There are no applicable EC objectives for CCWD Pumping Plant #1 noted in D-1641. However this location is evaluated to address potential concerns related to the CCWD's water supply intake.

Long-term average salinities at CCWD Pumping Plant #1 under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 2.6 percent lower in August to 1.6 percent higher in February (Appendix F5, 3 vs. 1, pg. 92). Average salinities by water year type would decrease by five percent or more (up to 9.0 percent) during July and August of critical years. In addition, average salinities by water year type would increase by five percent or more (6.1 percent) during August of dry years.

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 19.8 percent) during 4 of the 192 months modeled, and higher by ten percent or more (up to 16.8 percent) during 3 of the 192 months modeled (Appendix F5, 3 vs. 1, pg. 93 through 104).

Increases in salinity equal to or greater than five percent over the 16-year simulation period under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition generally occur during dry and critical years (**Table 9-81**).

Table 9-81. Differences in Monthly Mean Salinity (µS/cm) at the CCWD Pumping Plant #1, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

	Salinity Changes (µS/cm)		
Water Year Type	Increases ≥ 5% (range)	% Difference (range)	Month(s) and Number of Occurrences[a]
Wet	648	5	Feb (1)
Above Normal	---	---	---
Below Normal	---	---	---
Dry	558 - 911	6-17	Jan (1), Feb (1), Jul (1), Aug (2), Sep (1)
Critical	747 – 1,039	6	Feb (1), Aug (1)

[a] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-82**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Table 9-82. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	641	743	825	535	642	753	862	546	1 (0%)	11 (1%)	37 (4%)	11 (2%)
1987	741	665	732	374	754	707	749	377	13 (2%)	42 (6%)	17 (2%)	3 (1%)
1990	733	1,036	707	402	739	1,070	747	411	6 (1%)	34 (3%)	40 (6%)	8 (2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.5-20: Salinity changes in the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The applicable EC objective for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 1,000 µS/cm year-round.

Long-term average salinities at Clifton Court Forebay under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 2.7 percent lower in August to 1.9 percent higher in January (Appendix F5, 3 vs. 1, pg. 92). Average salinities by water year type would decrease by five percent or more (up to 9.1 percent) during July and August of critical years. In addition, average salinities by water year type would increase by five percent or more (up to 5.8 percent) during January, July and August of dry years.

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative are lower than the CEQA Existing Condition by ten percent or more (up to 20.5 percent) during 4 of the 192 months modeled, and higher by ten percent or more (up to 18.9 percent) during 3 of the 192 months modeled (Appendix F5, 3 vs. 1, pg. 106 through 117). Modeled monthly average EC values under both alternatives between October and September would consistently be in compliance with D-1641 standards.

Increases in salinity equal to or greater than five percent over the 16-year simulation period under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition generally occur during dry and critical years (**Table 9-83**).

Table 9-83. Differences in Monthly Mean Salinity (µS/cm) in the West Canal at the Mouth of Clifton Court Forebay (SWP Intake), by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

	Salinity Changes (µS/cm)		
Water Year Type	**Increases ≥ 5% (range)**	**% Difference (range)**	**Month(s) and Number of Occurrences[a]**
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	540-689	5 -1 2	Jan (1), Feb (1), Jul (1), Aug (1), Sep (1)
Critical	683	6	Feb (1)

[a] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-84**).

Table 9-84. Differences in Monthly Mean Salinity (µS/cm) in the West Canal at the Mouth of Clifton Court Forebay (SWP Intake), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
Year	**CEQA Existing Condition**				**CEQA Yuba Accord Alternative**				**Absolute Difference (Relative Difference)[a]**			
	Dec	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	524	601	680	563	524	607	700	571	0 (0%)	6 (1%)	20 (3%)	8 (1%)
1987	597	565	651	558	606	586	660	561	9 (1%)	21 (4%)	9 (1%)	3 (0%)
1990	601	788	650	563	604	811	679	569	3 (0%)	22 (3%)	29 (4%)	6 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-21: Salinity changes in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The applicable EC objective for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 1,000 µS/cm year-round.

Long-term average salinities at Jones Pumping Plant under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 2.0 percent lower in August to 0.9 percent higher in February (Appendix F5, 3 vs. 1, pg. 118). Average salinities by water year type under the CEQA Yuba Accord Alternative and CEQA Existing Condition differ by five percent or more only one time – an 8.0 percent decrease during August of critical years.

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 17.8 percent) during 2 of the 192 months modeled, and higher by ten percent or more (13.7 percent) during 1 of the 192 months modeled (Appendix F5, 3 vs. 1, pg. 119 through 130). Modeled monthly average EC values under both alternatives would consistently be in compliance with D-1641 standards.

Increases in salinity equal to or greater than five percent under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition generally occur during dry and critical years (**Table 9-85**).

Table 9-85. Differences in Monthly Mean Salinity (µS/cm) in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Intake), by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

	Salinity Changes (µS/cm)		
Water Year Type	**Increases ≥ 5% (range)**	**% Difference (range)**	**Month(s) and Number of Occurrences[a]**
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	453 - 621	5 - 14	Jan (1), Jul (1), Aug (2)
Critical	738	5	Aug (1)

[a] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-86**).

Table 9-86. Differences in Monthly Mean Salinity (µS/cm) in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
Year	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	533	609	689	597	533	614	706	605	0 (0%)	5 (1%)	17 (2%)	7 (1%)
1987	597	578	662	582	605	596	671	585	8 (1%)	18 (3%)	9 (1%)	3 (0%)
1990	607	777	672	584	610	795	698	590	3 (0%)	18 (2%)	26 (4%)	6 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-22: Salinity changes at Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Middle River at Victoria Canal is an indicator of central Delta water quality and the water quality at Victoria Island agricultural siphons. There are no applicable EC objectives for Middle River at Victoria Canal noted in D-1641.

Long-term average salinities at Victoria Canal under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 1.4 percent lower in August to 1.0 percent higher in February (Appendix F5, 3 vs. 1, pg. 131). Average salinities by water year type under the CEQA Yuba Accord Alternative and CEQA Existing Condition would differ by five percent or more only one time – a 6.7 percent decrease during August of critical years.

Over the entire 16-year simulation period, monthly average salinities under the CEQA Yuba Accord Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 15.2 percent) during 2 of the 192 months modeled, and higher by ten percent or more (12.2 percent) during 1 of the 192 months modeled (Appendix F5, 3 vs. 1, pg. 171 through 182).

Increases in salinity equal to or greater than five percent over the 16-year simulation period under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition generally occur during dry and critical years (**Table 9-87**).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-88**).

Table 9-87. Differences in Monthly Mean Salinity (µS/cm) in the Middle River at Victoria Canal, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Water Year Type	Salinity Changes (µS/cm)		
	Increases ≥ 5% (range)	% Difference (range)	Month(s) and Number of Occurrences[a]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	339 - 546	6-12	Jan (1), Feb (1), Jul (1), Aug (1)
Critical	591	5	Feb (1)

[a] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent.

Table 9-88. Differences in Monthly Mean Salinity (µS/cm) in Victoria Canal, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Year	Monthly Mean Salinity (µS/cm)											
	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	397	468	547	461	398	471	563	470	0 (0%)	3 (1%)	16 (3%)	9 (2%)
1987	490	446	534	464	493	463	546	469	3 (1%)	17 (4%)	12 (2%)	5 (1%)
1990	448	609	563	419	448	625	591	427	0 (0%)	16 (3%)	29 (5%)	8 (2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-23: Salinity changes at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns related to the City of Stockton's water supply intake.

Long-term average salinities at the Stockton Intake under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 1.7 percent lower in August to 1.3 percent higher in January (Appendix F5, 3 vs. 1, pg. 144). Average salinities by water year type under the CEQA Yuba Accord Alternative and CEQA Existing Condition would differ by five percent or more only one time – a 7.3 percent decrease during August of critical years.

Over the entire 16-year simulation period, monthly mean salinities under the CEQA Yuba Accord Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 16.8 percent) during 3 of the 192 months modeled, and higher by ten percent or more (up to 12.9 percent) during 2 of the 192 months modeled.

Increases in salinity equal to or greater than five percent over the 16-year simulation period under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition generally occur during dry and critical years (**Table 9-89**).

Table 9-89. Differences in Monthly Mean Salinity (μS/cm) at the Stockton Intake, by Water Year Type, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

	Salinity Changes (μS/cm)		
Water Year Type	Increases ≥ 5% (range)	% Difference (range)	Month(s) and Number of Occurrences[a]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	312 - 452	7-13	Jan (1), Feb (1), Jul (1), Aug (2)
Critical	470	5	Aug (1)

[a] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-90**).

Table 9-90. Differences in Monthly Mean Salinity (μS/cm) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

	Monthly Mean Salinity (μS/cm)											
	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	360	421	490	354	360	428	508	360	0 (0%)	6 (2%)	18 (4%)	6 (2%)
1987	392	381	442	336	402	399	452	340	9 (2%)	18 (5%)	10 (2%)	4 (1%)
1990	438	553	461	312	442	574	483	315	4 (1%)	21 (4%)	22 (5%)	3 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-24: Changes in chloride concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objective for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations at Highway 4 under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 0.3 percent lower in October and November to 6.0 percent higher in February (Appendix F5, 3 vs. 1, pg. 157). Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would not exceed about 2 percent except during January, February, July, and August of dry years when they would be 7.2

percent, 21.4 percent, 7.8 percent, and 8.0 percent higher, respectively; as well as during July, August, and September of critical years when they would be 7.3 percent, 11.3 percent, and 4.6 percent lower (Appendix F5, 3 vs. 1, pg. 158 through 169).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 23 of the 192 months modeled. During these 23 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 13 occasions and lower on 10 occasions, compared to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA Yuba Accord Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 29.7 percent) during 7 of the 192 months modeled and higher by ten percent or more (up to 75.0 percent) during 5 of the 192 months modeled (Appendix F5, 3 vs. 1, pg. 158 through 169). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-91**.

Table 9-91. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake) from October Through September Over the 16-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	126.9	102.0	102.5	89.7	70.1	44.5	37.0	41.3	46.9	54.9	92.5	126.3
CEQA Existing Condition	127.3	102.3	102.3	87.7	66.1	44.5	37.0	42.6	47.3	55.9	95.8	128.3

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta are similar in nature to those previously discussed for salinity. During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in salinity exhibited in the January and February output.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-92**).

Table 9-92. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	114	136	154	60	114	139	163	61	0 (0%)	3 (2%)	9 (6%)	2 (3%)
1987	134	113	129	44	139	123	133	45	4 (3%)	10 (9%)	4 (3%)	1 (1%)
1990	143	203	82	46	145	212	88	48	2 (1%)	9 (4%)	5 (6%)	1 (3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-25: Changes in chloride concentrations in CCWD Pumping Plant #1 (Rock Slough) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for CCWD Pumping Plant #1 (Rock Slough) is 150 mg/l year-round.

Long-term average chloride ion concentrations at CCWD Pumping Plant #1 (Rock Slough) under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 0.2 percent lower in October and December to 1.7 percent higher in February (Appendix F5, 3 vs. 1, pg. 170). Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would not exceed about 4 percent except during July and August of dry when they would be approximately 7 percent to approximately 12 percent higher, and July and August of critical years when they would be 7 percent to 11 percent lower.

Over the entire 16-year simulation period, monthly average chloride concentrations would exceed 150 mg/l under both the CEQA No Project Alternative and CEQA Existing Condition 45 of the 192 months modeled. During those 45 months when chloride ion concentrations exceeded 150 mg/l, concentrations were higher under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative by 0.1 percent to 22.5 percent on 15 occasions, and lower by 0.1 percent to 22.9 percent on 30 occasions (Appendix F5, 3 vs. 1, pg. 171 through 182). There was also 1 less occurrence under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition during a critical water year when monthly mean chloride ion concentrations exceeded 150 mg/l by 2.6 percent. Monthly mean chloride ion concentrations from October through September are presented in **Table 9-93**.

Table 9-93. Monthly Mean Chloride Ion Concentrations (mg/l) CCWD Pumping Plant #1 (Rock Slough) from October Through September Over the 16-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	154.1	123.7	119.0	111.0	89.0	64.7	58.3	43.0	43.7	67.5	115.4	150.8
CEQA Existing Condition	154.4	124.1	119.2	109.4	87.5	64.6	58.2	43.2	44.7	68.8	119.9	153.1

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta over the 16-year simulation period are dependent on modeling assumptions and real-time operations in the Yuba River Basin.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-94**).

Table 9-94. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at CCWD Pumping Plant #1 (Rock Slough), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	114	134	143	89	114	137	149	91	0 (0%)	2 (2%)	7 (5%)	2 (3%)
1987	161	135	124	56	165	145	127	57	4 (2%)	9 (7%)	4 (3%)	0 (1%)
1990	156	188	117	63	156	193	123	64	0 (0%)	5 (3%)	7 (6%)	1 (2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-26: Changes in chloride concentrations in Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives for Old River at Rock Slough (CCWD Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations in Old River at Rock Slough under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 0.2 percent lower in October to 6.2 percent higher in February (Appendix F5, 3 vs. 1, pg. 183). Differences in average chloride ion concentration by water year type do not exceed 5 percent except during July and August of dry years when they would be approximately 9 percent to 7 percent higher, and during July and August of critical years when they would be 8 percent to 11 percent lower under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition.

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 27 of the 192 months modeled. During these 27 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 14 occasions and lower on 13 occasions, compared to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA Yuba Accord Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 27.6 percent) during 8 of the 192 months modeled and higher by ten percent or more (up to 76.1 percent) during 6 of the 192 months modeled (Appendix F5, 3 vs. 1, pg. 184 through 195) . Monthly mean chloride ion concentrations from October through September are presented in **Table 9-95**.

Table 9-95. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Rock Slough (CCWD Intake) from October Through September Over the 16-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
CEQA Yuba Accord Alternative	143.7	111.7	115.2	95.1	67.1	35.9	28.8	32.1	34.6	62.9	113.9	154.1
CEQA Existing Condition	144.0	112.2	114.9	92.5	63.2	36.0	28.8	33.2	35.6	64.7	118.5	155.8

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-96**).

Table 9-96. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Rock Slough (CCWD Intake), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				**CEQA Yuba Accord Alternative**				**Absolute Difference (Relative Difference)[a]**			
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	136	157	169	56	136	161	180	58	0 (0%)	4 (3%)	10 (6%)	1 (3%)
1987	153	126	131	32	159	138	135	32	7 (4%)	12 (9%)	4 (3%)	0 (1%)
1990	178	231	80	38	181	242	85	39	3 (1%)	11 (5%)	5 (7%)	1 (3%)
[a] Values in parentheses represent the relative difference in monthly mean salinity.												

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-27: Changes in chloride concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 0.5 percent lower in October to 5.3 percent higher in February (Appendix F5, 3 vs. 1, pg. 196). Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would not exceed about 5 percent except during February, July, and August of dry years when they would be 16.3 percent, 6.1 percent, and 8.2 percent higher; and during August and September of critical years when they would be 10.6 percent and 6.4 percent lower.

Over the entire 16-year simulation period, monthly mean chloride concentrations would not exceed 250 mg/l under either the CEQA Yuba Accord Alternative or the CEQA Existing Condition (Appendix F5, 3 vs. 1, pg. 184 through 195). However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 15 of the 192 months modeled. During these 15 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 5 occasions and lower on 10 occasions, compared to the CEQA Existing Condition. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 8 of the 192 months modeled, and would be higher on 2 (up to 54.8 percent) occasions and lower on 5 (up to 22.0 percent) occasions under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition. Monthly mean chloride ion concentrations from October through September are presented in **Table 9-97**.

Table 9-97. Monthly Mean Chloride Ion Concentrations (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant) from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
CEQA No Project Alternative	100.1	86.3	82.6	75.7	61.0	45.0	38.8	40.1	47.0	46.3	68.4	94.2
CEQA Existing Condition	100.6	86.6	82.6	74.5	57.9	44.9	38.7	41.1	47.1	46.6	70.3	96.2

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta over the 16-year simulation period are dependent on modeling assumptions and real-time operations in the Yuba River Basin.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-98**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Table 9-98. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	86	105	124	63	86	107	130	65	0 (0%)	1 (1%)	6 (5%)	2 (3%)
1987	107	94	113	58	109	100	116	58	2 (2%)	6 (7%)	3 (3%)	1 (1%)
1990	102	157	85	53	103	162	91	55	1 (1%)	6 (4%)	6 (7%)	2 (3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.5-28: Changes in chloride concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 0.2 percent lower in November to 4.2 percent higher in February (Appendix F5, 3 vs. 1, pg. 209). Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would not exceed approximately 5 percent except during February and August of dry years when they would be 12.6 percent and 6.9 percent higher; and in May, July, and August of critical years when they would be 5.8 percent, 5.7 percent, and 10.5 percent lower.

Over the entire 16-year simulation period, monthly mean chloride concentrations would not exceed 250 mg/l under either the CEQA Yuba Accord Alternative or the CEQA Existing Condition (Appendix F5, 3 vs. 1, pg. 210 through 221). However, differences in chloride ion concentrations equal to or greater than 5 percent occurred during 16 of the 192 months modeled. During these 16 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 8 occasions and lower on 8 occasions, compared to the CEQA Existing Condition. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 9 of the 192 months modeled, and would be higher (up to 50.2 percent) on 5 occasions and lower (up to 24.4 percent) on 4 occasions under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition. Monthly mean chloride ion concentrations from October through September are presented in **Table 9-99**.

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta over the 16-year simulation period are dependent on modeling assumptions and real-time operations in the Yuba River Basin.

Table 9-99. Monthly Mean Chloride Ion Concentrations (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) from October Through September Over the 16-year Simulation Period Under the CEQA Accord Alternative and the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	100.9	86.3	87.5	80.4	70.3	60.1	45.6	42.7	54.3	54.3	79.7	109.1
CEQA Existing Condition	101.2	86.5	87.5	79.4	67.4	60.1	45.6	43.7	54.4	54.9	82.0	110.6

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-100**).

Table 9-100. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	93	111	131	78	93	113	135	79	0 (0%)	1 (1%)	4 (3%)	1 (1%)
1987	108	104	124	75	110	108	126	76	2 (2%)	4 (4%)	2 (2%)	0 (1%)
1990	111	152	89	76	111	157	93	77	1 (1%)	5 (3%)	4 (4%)	1 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in less than significant impacts on Delta water quality.

Impact 9.2.5-29: Changes in chloride concentrations in Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives in Middle River at Victoria Canal noted in D-1641. However, Middle River at Victoria Canal is an indicator of central Delta water quality and water quality at the Victoria Island agricultural siphons, and is therefore evaluated.

Long-term average chloride ion concentrations in Middle River at Victoria Canal under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 0.3 percent lower in October to 3.7 percent higher in February (Appendix F5, 3 vs. 1, pg. 222). Differences in average chloride ion concentration by water year type under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would not exceed approximately 5 percent except during February and August of dry years when they would be 13 percent and 7.7 percent higher; and during August of critical years when they would be about 10 percent lower.

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 20 of the 192 months modeled (Appendix F5, 3 vs. 1, pg. 223 through 234). During these 20 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 11 occasions and lower on 9 occasions, compared to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA Yuba Accord Alternative are lower than the CEQA Existing Condition by ten percent or more (up to 25.3 percent) during 5 of the 192 months modeled and higher by ten percent or more (up to 48.3 percent) during 5 of the 192 months modeled. Monthly mean chloride ion concentrations from October through September are presented in **Table 9-101**.

Table 9-101. Monthly Mean Chloride Ion Concentrations (mg/l) in Middle River at Victoria Canal from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	75.8	69.9	63.2	63.0	57.0	46.0	41.7	47.4	54.9	39.6	48.7	66.0
CEQA Existing Condition	76.0	70.0	63.3	62.3	55.0	46.0	41.6	48.7	54.8	39.5	49.9	67.1

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta over the 16-year simulation period are dependent on modeling assumptions and real-time operations in the Yuba River Basin.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-102**).

Table 9-102. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Middle River at Victoria Canal, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	59	76	95	57	59	77	99	58	0 (0%)	1 (1%)	4 (4%)	1 (2%)
1987	82	71	92	58	82	75	95	58	1 (1%)	4 (6%)	3 (3%)	1 (1%)
1990	71	111	72	51	71	115	77	52	0 (0%)	4 (3%)	4 (6%)	1 (2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in less than significant impacts Delta water quality.

Impact 9.2.5-30: Changes in chloride concentrations at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives at the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns associated with the City of Stockton's water supply intake.

Long-term average chloride ion concentrations at the Stockton Intake under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition, would range from 0.1 percent lower in October to 3.7 percent higher in February (Appendix F5, 3 vs. 1, pg. 235). Differences in average chloride ion concentration by water year type would not exceed approximately 2 percent except during July of above normal years when they would be 7.5 percent higher; February, July and August of dry years when they would be 12.3 percent, 8.4 percent, and 8.5 percent higher; and April, July, August, and September of critical years when they would be 6.1 percent, 8.3 percent, 11.7 percent, and 4.7 percent lower.

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occurred during 26 of the 192 months modeled. During these 26 months, chloride ion concentrations would be higher under the CEQA Yuba Accord Alternative on 15 occasions and lower on 11 occasions, compared to the CEQA Existing Condition. Differences in monthly mean chloride ion concentrations under the CEQA Yuba Accord Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 24.7 percent) during 8 of the 192 months modeled and higher by ten percent or more (up to 41.8 percent) during 5 of the 192 months modeled. Monthly mean chloride ion concentrations from October through September are presented in **Table 9-103**.

Table 9-103. Monthly Mean Chloride Ion Concentrations (mg/l) at the Stockton Intake from October Through September Over the 16-year Simulation Period Under the CEQA Yuba Accord Alternative and the CEQA Existing Condition

	Monthly Mean Chloride Ion Concentration (mg/l)											
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Yuba Accord Alternative	57.4	50.3	46.2	46.7	41.0	32.2	36.3	44.1	32.8	26.1	36.7	49.6
CEQA Existing Condition	57.4	50.4	46.0	45.6	39.5	32.1	36.3	45.2	32.7	26.5	37.9	50.2

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta over the 16-year simulation period are dependent on modeling assumptions and real-time operations in the Yuba River Basin.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-104**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in less than significant impacts on Delta water quality.

Table 9-104. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Yuba Accord Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	50	65	82	41	50	66	86	42	0 (0%)	2 (2%)	4 (5%)	1 (2%)
1987	58	55	70	38	60	59	72	39	2 (4%)	4 (8%)	2 (4%)	1 (2%)
1990	69	97	57	35	70	102	60	35	1 (1%)	5 (5%)	3 (6%)	0 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.5-31: Changes in DOC concentrations at Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no DOC objectives noted in D-1641 for any location within the Delta. However, consideration of data regarding the average DOC concentrations in the Delta, assumed levels of natural variation, and assumed relationships between DOC concentrations and THM formation in drinking water has resulted in establishment of a monthly change significance criterion for DOC of 0.4 mg/l (see Section 9.2.2.1).

Long-term average DOC concentrations and average DOC concentrations by water year type at Highway 4 under the CEQA Yuba Accord Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types (Appendix F5, 3 vs. 1, pg. 248). Monthly mean DOC concentrations also would be similar under each alternative, with a maximum absolute change of 0.1 mg/l (Appendix F5, 3 vs. 1, pg. 249 through 260). Consequently, changes in the monthly mean DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact to Delta water quality.

Impact 9.2.5-32: Changes in DOC concentrations at Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations and average DOC concentrations by water year type in the Old River at Rock Slough under the CEQA Yuba Accord Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types (Appendix F5, 3 vs. 1, pg. 261). Monthly mean DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 3 vs. 1, pg. 262 through 273). Consequently, changes in the monthly mean DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact to Delta water quality.

Impact 9.2.5-33: Changes in DOC concentrations at West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations and average DOC concentrations by water year type at Clifton Court Forebay under the CEQA Yuba Accord Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types (Appendix F5, 3 vs. 1, pg. 274) . Monthly mean DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.1 mg/l (Appendix F5, 3 vs. 1, pg. 275 through 286). Consequently, changes in the monthly mean DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact to Delta water quality.

Impact 9.2.5-34: Changes in DOC concentrations at the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average DOC concentrations and average DOC concentrations by water year type at the Jones Pumping Plant under the CEQA Yuba Accord Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types (Appendix F5, 3 vs. 1, pg. 287). Monthly mean DOC concentrations also would be similar under each alternative, with a maximum absolute change of 0.1 mg/l (Appendix F5, 3 vs. 1, pg. 288 through 299). Consequently, changes in the monthly mean DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact to Delta water quality.

Impact 9.2.5-35: Changes in monthly mean flows in Old River at Bacon Island that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Old River at Bacon Island under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition would not exceed approximately 2 percent (Appendix F5, 3 vs. 1, pg. 300). The direction of flow under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition moves towards the Delta pumps during all months and water years except during February through April of wet years. The magnitude of flows moving towards Delta pumps during February through May of all water years would be essentially equivalent or reduced during most months and water years under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition. In general, the magnitude of flows moving towards Delta pumps during wet, above normal, and below normal years would be between about 6 cfs and about 190 cfs less from June through September under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition. Increases in the magnitude of flows moving towards Delta pumps would be between about 1 cfs and about 200 cfs higher during some months of dry and critical water years under the CEQA Yuba Accord Alternative.

The flow of water in Old River at Bacon Island is often used as an indicator of hydraulic conditions in the south Delta. Since average monthly flows always moves towards the Delta pumps (negative flows) in dry and critical years, the magnitude of flows between the CEQA Yuba Accord Alternative and the CEQA Existing Condition is used as an indicator of potential adverse impacts. Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 25 of the 192 months modeled, and would be essentially equivalent or are less negative for the remaining 167 months (Appendix F5, 3 vs. 1, pg. 301 through 312).

Overall, potential changes in monthly mean flows under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-36: Changes in monthly mean flows in the Middle River at Middle River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Middle River at Middle River would be essentially equivalent under the CEQA Yuba Accord Alternative, compared to those under the CEQA Existing Condition (Appendix F5, 3 vs. 1, pg. 313). The direction of flow under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition moves towards the Delta pumps during all months and water years. The magnitude of flows moving towards Delta pumps under the CEQA Yuba Accord Alternative during February through May would be reduced, and would be essentially equivalent, compared to those under the CEQA Existing Condition during most months and water years except dry and critical years. During these times the rate of flow movement towards Delta pumps would be up to about 25 cfs higher during February and about 25 cfs lower in March and May of dry years; and about 15 cfs lower during February of critical years under the CEQA Yuba Accord Alternative. In general, the magnitude of flows moving towards Delta pumps is between about 2 cfs and about 130 cfs lower from June through November of wet and above normal years, and about 2 cfs to 135 cfs higher during some months of dry and critical years under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 25 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 167 months (Appendix F5, 3 vs. 1, pg. 314 through 325).

Overall, potential changes in monthly mean flows under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.5-37: Changes in monthly mean flows in the Middle River at Mowry Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Middle River at Mowry Bridge would be essentially equivalent under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition Appendix F5, 3 vs. 1, pg. 326) . The direction of flow moves away from the Delta pumps and would be essentially equivalent during most months and water years under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition. Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would have a less than significant impact on Delta water quality.

Impact 9.2.5-38: Decreases in San Luis Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Historically, the CVP and SWP have cooperated to try to maintain San Luis Reservoir above 300 TAF in response to the low-point problem and thus, avoid adverse impacts to water quality. Combined long-term average monthly CVP and SWP reservoir storage and average monthly reservoir storage by water year type under the CEQA Yuba Accord Alternative is essentially equivalent in San Luis Reservoir, compared to the CEQA Existing Condition over the 72-year simulation period (Appendix F4, 3 vs. 1, pg. 1339). Combined average monthly CVP and SWP reservoir storage by water year type would be essentially equivalent except during some months during dry and critical water years. Differences in combined reservoir storage during these months and water years would not exceed 4 percent. In addition, there would be no additional months when combined CVP (Appendix F4, 3 vs. 1, pg. 1340 through 1351) and SWP (Appendix F4, 3 vs. 1, pg. 1377 through 1388) monthly mean reservoir storage drops below 300 TAF under the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in San Luis Reservoir.

9.2.6 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE CEQA MODIFIED FLOW ALTERNATIVE COMPARED TO THE CEQA EXISTING CONDITION

Impact 9.2.6-1: Decreases in New Bullards Bar Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year simulation period, differences in long-term average end-of-month reservoir storage and reservoir storage by water year type under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would not exceed 4 percent. During periods exhibiting the lowest storage conditions[35], average differences in average end-of-month reservoir storage under the CEQA Modified Flow Alternative would be about 2 percent higher in August, September, October, and November(Appendix F4, 4 vs. 1, pg. 1). Under the CEQA Modified Flow Alternative, monthly mean storage during all months would be essentially equivalent[36] and higher 80 percent to 100 percent of the time over the cumulative reservoir storage distributions compared to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 26 through 37).

Overall, frequency and magnitude of changes in end-of-month storage would not be sufficient to reduce the long-term water quality in New Bullards Bar Reservoir. Therefore, the CEQA Modified Flow Alternative, compared to the CEQA Existing Condition, would result in less than significant impacts to water quality in New Bullards Bar Reservoir.

Impact 9.2.6-2: Changes in monthly mean flows in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

During the seasonal high flow period[37], long-term average flows in the lower Yuba River at Smartville would range from about 1 percent lower in March to approximately 3 percent higher in December under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition over the 72-year simulation period. During the seasonal low flow period[38], flows in the lower Yuba River at Smartville would range from approximately 5 percent lower in August to essentially equivalent in October and November. Maximum decreases in average monthly flow under the CEQA Modified Flow Alternative would range from about 7 percent to 9 percent and occur during July and August of above normal water years (Appendix F4, 4 vs. 1,

[35] Generally, ranging from August through November.

[36] Essentially equivalent refers to relative differences in storage volume equal to less than 1 percent (See Section 9.2.1).

[37] Generally, ranging from December through June in the lower Yuba River.

[38] Generally, ranging from August through November in the lower Yuba River.

pg. 100). During typically low flow conditions[39] occurring from August through November, flows under the CEQA Modified Flow Alternative would be on average about 5 percent to 10 percent higher, about 65 percent to 95 percent of the time (Appendix F4, 4 vs. 1, pgs. 125, 126, 135, and 136).

During the seasonal high flow period, differences in long-term average flows in the lower Yuba River at Marysville would not exceed approximately 4 percent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. During the seasonal low flow period, flows in the lower Yuba River at Marysville would range from approximately 16 percent lower in August to approximately essentially equivalent in November under the CEQA Modified Flow Alternative. Maximum decreases in flows under the CEQA Modified Flow Alternative would range from about 20 percent to 24 percent, and occur during July and August of below normal water years (Appendix F4, 4 vs. 1, pg. 272). During typically low flow conditions flows under the CEQA Modified Flow Alternative would be on average about 15 percent lower in August 75 percent of the time; 10 percent higher in September 15 percent of the time; 5 percent lower in October 28 percent of the time; and 5 percent higher in November 85 percent of the time (Appendix F4, 4 vs. 1, pgs. 297, 298, 307, and 308).

Overall, lower Yuba River flows under the CEQA Yuba Accord Alternative would be slightly lower than flows under the CEQA Existing Condition from June through October. However these slight decreases in flow would not result in any long-term impacts to designated beneficial uses, existing regulatory standards, degradation of general water quality. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Yuba River.

Impact 9.2.6-3: Changes in monthly mean water temperatures in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average water temperatures in the lower Yuba River at Smartville under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would be essentially equivalent[40] during all months (Appendix F4, 4 vs. 1, pg. 174). Long-term average water temperatures at Marysville also would be essentially equivalent during most months with the exception of July, August, and September when water temperatures would range from 0.4°F to 0.9°F higher under the CEQA Modified Flow Alternative. However water temperatures during these times would not exceed 63.0°F. During July through September of all water years, water temperatures would range from 0.4°F to 1.4°F higher, except during August of critical water years when they would be 0.4°F lower. When water temperatures would be higher compared to the CEQA Existing Condition, they would remain below approximately 67°F (Appendix F4, 4 vs. 1, pg. 346).

Long-term average water temperatures at Daguerre Point Dam under the CEQA Modified Flow Alternative during the April through July period would be essentially equivalent during most months, and would not exceed about 58°F under either alternative. Average monthly water temperatures during all water years under the CEQA Modified Flow Alternative at Daguerre Point Dam are essentially equivalent to the CEQA Existing Condition and generally would remain below 60°F (Appendix F4, 4 vs. 1, pg. 223). There is one occurrence over the 72-year period of simulation under the CEQA Modified Flow Alternative, relative to the CEQA Existing

[39] The lowest 25 percent of the monthly cumulative probability flow distribution.

[40] Essentially equivalent refers to differences in water temperature between the alternative and the basis of comparison that are less than or equal to 0.3 °F.

Condition during which monthly mean water temperatures occurring during July exceed 65ºF by approximately 2ºF (Appendix F4, 4 vs. 1, pg. 257).

Overall, lower Yuba River water temperatures under the CEQA Modified Flow Alternative would be similar to the CEQA Existing Condition. Water temperature changes occurring in the lower Yuba River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Yuba River.

Impact 9.2.6-4: Decreases in Oroville Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average end-of-month storage and average end-of-month storage by water year type under the CEQA Modified Flow Alternative would be essentially equivalent in Oroville Reservoir, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pg. 406). During all months, the cumulative reservoir storage distributions are essentially equivalent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition about 100 percent of the time (Appendix F4, 4 vs. 1, pgs. 431 through 442). Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in Oroville Reservoir.

Impact 9.2.6-5: Changes in monthly mean flows in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly flows or average monthly flows by water year type the Feather River below the Fish Barrier Dam under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition in (Appendix F4, 4 vs. 1, pg. 505).

Long-term average monthly flows in the Feather River below the Thermalito Afterbay Outlet would be essentially equivalent[41] during all months under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition except October when flows under the CEQA Modified Flow Alternative would be about 1 percent lower (Appendix F4, 4 vs. 1, pg. 603). Differences in long-term average monthly flows in the Feather River at the mouth would not exceed approximately 3 percent (Appendix F4, 4 vs. 1, pg. 775). Decreases in average monthly flow below the Thermalito Afterbay Outlet and at the mouth of the Feather River would range from 1 percent lower to approximately 7 percent lower during all water years (Appendix F4, 4 vs. 1, pgs. 603 and 775).

During typically low flow conditions occurring from September through November below the Thermalito Afterbay Outlet, flows under the CEQA Modified Flow Alternative would be essentially equivalent 100 percent of the time (Appendix F4, 4 vs. 1, pgs 639, 628, and 629). During low flow conditions (i.e., lowest 25 percent of the monthly cumulative probability distribution) at the mouth of the Feather River flows under the CEQA Modified Flow Alternative would be about 5 percent lower 70 percent of the time in September; 5 percent lower 50 percent of the time in October; and 5 percent lower 40 percent of the time in November (Appendix F4 4 vs. 1, pgs. 811, 800, and 801).

Overall, lower Feather River flows under the CEQA Modified Flow Alternative would not substantially change compared to the CEQA Existing Condition and, thus, would not be

[41] Essentially equivalent refers to relative differences in flows between the alternative and the basis of comparison that are less than or equal to 1 percent.

expected to degrade water quality or adversely affect beneficial uses. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Feather River.

Impact 9.2.6-6: Changes in monthly mean water temperatures in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses.

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition in the lower Feather River below the Thermalito Afterbay Outlet and at the mouth are essentially equivalent except during of August of dry water years at the mouth when water temperatures are 71.5ºF, and thus are 0.4ºF higher under the CEQA Modified Flow Alternative (Appendix F4, 4 vs. 1, pgs. 677 and 824). There are no differences in long-term average monthly water temperatures or average monthly water temperatures by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition below the Fish Barrier Dam (Appendix F4, 4 vs. 1, pg. 554).

Monthly mean water temperatures below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be essentially equivalent during all months to the CEQA Existing Condition 100 percent of the time over the cumulative water temperature distribution (Appendix F4, 4 vs. 1, pgs. 702 through 713). At the mouth of the Feather River, water temperatures would be essentially equivalent about 100 percent of the time during all months of the cumulative water temperature distribution with the exception of August. During August water temperatures would be essentially equivalent about 70 percent of the time and higher by an average of 0.4ºF about 30 percent of the time. During the highest 25 percent of the cumulative water temperature distribution (i.e., highest 25 percent of water temperatures), water temperatures in August under the CEQA Modified Flow Alternative would be on average 0.5ºF higher (not exceeding 76ºF) about 60 percent of the time, and essentially equivalent for the remainder of the distribution, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 849 through 860).

Overall, lower Feather River water temperatures under the CEQA Modified Flow Alternative would be similar to the CEQA Existing Condition. Water temperature changes occurring in the lower Feather River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Feather River.

Impact 9.2.6-7: Changes in monthly mean flows in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly flows or average monthly flows by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition in the Sacramento River below Keswick Dam (Appendix F4, 4 vs. 1 pg. 1562).

Long-term average monthly flows in the Sacramento River below the confluence with the Feather River and at Freeport under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would be essentially equivalent during most months. Differences in average monthly flows during all months and water years would be not exceed about 2 percent (Appendix F4, 4 vs. 1, pgs. 907 through 918 and 1030 through 1041). Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than a significant impact on water quality in the Sacramento River.

Impact 9.2.6-8: Changes in monthly mean water temperatures in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type in the Sacramento River below the Feather River confluence and at Freeport under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would be essentially equivalent (Appendix F4, 4 vs. 1, pgs. 956 and 1054). Water temperatures below the Feather River confluence and at Freeport would be essentially equivalent during all months under the CEQA Modified Flow Alternative approximately 100 percent of the time over the cumulative water temperature distribution (Appendix F4, 4 vs. 1, pgs. 981 through 992 and 1079 through 1090). Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than a significant impact on water quality in the Sacramento River.

Impact 9.2.6-9: Changes to the monthly mean location of X2 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The location of the estuarine salinity gradient is regulated during the months of February through June by the location of X2 objective in the 1995 WQCP (D-1641). The X2 location must remain downstream of the Confluence of the Sacramento and San Joaquin rivers[42] (River Kilometer 81, located upstream from the Golden Gate Bridge) for the entire 5-month period. The X2 objective also specifies the number of days each month that that location of X2 must be downstream of Chipps Island (RK 74) or downstream of Roe Island[43] (RK 64). However, due to DSM2 modeling limitations these two locations are not evaluated (see Section 9.2.1.2). The long-term average monthly mean X2 location from February through June under the CEQA Modified Flow Alternative and the CEQA Existing Condition are presented in **Table 9-105**. During all months of the year, the long-term average and average location of X2 by water year type would remain essentially equivalent under CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pg. 1189).

Table 9-105. Monthly Mean X2 Location (RK) from February Through June Over the 72-year Simulation Period Under the CEQA Modified Flow Alternative and the CEQA Existing Condition

Monthly Mean X2 Location (RK)					
Alternative	**Feb**	**Mar**	**Apr**	**May**	**Jun**
CEQA Modified Flow Alternative	71.5	66.5	66.0	67.9	70.1
CEQA Existing Condition	71.5	66.5	66.0	67.9	70.1

Delta outflow objectives established in SWRCB D-1641 extend throughout the year. For the February though June period under the CEQA Modified Flow Alternative, Delta outflow objectives are met by compliance with the X2 objective. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Based on this analysis the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

[42] Also referred to as Collinsville.

[43] Also referred to as the Port Chicago EC monitoring station.

Impact 9.2.6-10: Changes to monthly mean Delta outflow that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

As described above, delta outflow objectives established in SWRCB D-1641 extend throughout the year. For the February though June period, Delta outflow objectives would be met by compliance with the X2 objective. Delta outflow objectives would be met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641.

Over the entire 72-year period of simulated outflows, long-term average Delta outflow would be essentially equivalent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Average monthly flows by water year type under both the CEQA Modified Flow Alternative and the CEQA Existing Condition meet minimum outflow requirements, as defined in the SWRCB D-1641. Differences in average monthly flows between the CEQA Modified Flow Alternative and the CEQA Existing Condition would not exceed 1 percent (Appendix F4, 4 vs. 1, pg. 1140). Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.6-11: Changes to monthly mean E/I ratios that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The Delta E/I ratio limits, established in SWRCB D-1641, specify that up to 35 percent of Delta inflows may be exported during the February through June period, and up to 65 percent of Delta inflows may be exported during the remaining months (i.e., July through January). These limits would be consistently met under both the CEQA Modified Flow Alternative and the CEQA Existing Condition. In addition, differences in average monthly E/I ratios between the CEQA Modified Flow Alternative and the CEQA Existing Condition would be essentially equivalent during most months and differences that would occur would not exceed 2 percent (Appendix F4, 4 vs. 1, pg. 1238). Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.6-12: Salinity changes in the Sacramento River at Emmaton that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Emmaton during the April through August period range from 450 to 2,780 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Over the entire 16-year simulation period, long-term average salinities at Emmaton under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from essentially equivalent during most months to 1.1 percent higher in July and August. Average salinities by water year type would be generally similar, although during some months and water year types, salinities under the CEQA Modified Flow Alternative would be up to 4.7 percent higher than salinities under the CEQA Existing Condition (Appendix F5, 4 vs. 1, pg. 1).

Monthly average salinities under the CEQA Modified Flow Alternative and the CEQA Existing Condition would not differ by ten percent or more. However, salinities under the CEQA Modified Flow Alternative would be equal to or greater than five percent compared to those under the CEQA Existing Condition during 6 of the 192 months modeled (one occasion during January of a wet and a critical year; and two occasions during July and August of dry years). Monthly average salinities under the CEQA Modified Flow Alternative between April and August would not comply with D-1641 standards 1 additional time (1 below normal year in

August), relative to the CEQA Existing Condition. During the 17 modeled months in which neither alternative would comply with D-1641 standards, EC conditions would measurably improve (by up to 8.1 percent) under the CEQA Modified Flow Alternative during 2 months, and measurably decline (by up to 5.1 percent) during 7 months (Appendix F5, 4 vs. 1, pgs. 2 through 13).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-106**).

Table 9-106. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,073	1,195	887	410	1,073	1,255	916	414	0 (0%)	60 (5%)	29 (3%)	4 (1%)
1987	1,964	1,210	455	188	1,841	1,095	436	187	-123 (-6%)	-115 (-10%)	-19 (-4%)	-1 (-1%)
1990	1,828	932	424	544	1,831	882	408	542	3 (0%)	-50 (-5%)	-16 (-4%)	-3 (0%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-13: Salinity changes in the San Joaquin River at Jersey Point that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Jersey Point during the April through August period range from 450 to 2,200 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative and the CEQA Existing Condition would not differ by ten percent or more, and monthly average salinities between April and August under these alternatives would comply with D-1641 standards with equal probability. Salinities under the CEQA Modified Flow Alternative, compared to the CEQA Existing Condition would be equal to or greater than five percent during 4 of the 192 months modeled (one occasion during January and February of wet years; and one occasion during July and August of dry years). In addition, during the 23 modeled months in which neither alternative would comply with D-1641 standards, EC conditions would measurably improve (by up to 6.8 percent) under the CEQA Modified Flow Alternative during 5 months, and measurably decline (by up to 8.1 percent) during 5 months (Appendix F5, 4 vs. 1, pgs. 15 through 26).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-107**).

Table 9-107. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
Year	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,755	1,754	1,536	785	1,756	1,816	1,598	796	0 (0%)	62 (4%)	62 (4%)	11 (1%)
1987	1,796	1,611	931	276	1,673	1,456	877	270	-123 (-7%)	-156 (-10%)	-54 (-6%)	-5 (-2%)
1990	2,475	1,919	843	552	2,479	1,842	797	544	3 (0%)	-77 (-4%)	-46 (-5%)	-7 (-1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-14: Salinity changes in the San Joaquin River at Airport Way Bridge (Vernalis) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Airport Way Bridge (Vernalis) are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the CEQA Modified Flow Alternative indicate no change in EC values, relative to the CEQA Existing Condition. Similarly, monthly average salinities would also be identical under each alternative, and consequently would not indicate changes in the ability to meet D-1641 compliance standards (Appendix F5, 4 vs. 1, pg. 27). Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.6-15: Salinity changes in the San Joaquin River at Brandt Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Brandt Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period (Appendix F5, 4 vs. 1, pg. 40).

Long-term average salinities and average salinities by water year type under the CEQA Modified Flow Alternative indicate no change in EC values, relative to the CEQA Existing Condition. Monthly average salinities would also be similar under each alternative, with only 7 of the 192 months modeled indicating any difference, and a maximum relative change of less than 0.1 percent (Appendix F5, 4 vs. 1, pgs. 41 through 52). Consequently, monthly average salinities would comply with D-1641 standards. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.6-16: Salinity changes in Middle River near Old River that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Middle River near Old River are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the CEQA Modified Flow Alternative would only indicate negligible changes (up to 0.4 percent) in EC values, relative to the CEQA Existing Condition (Appendix F5, 4 vs. 1, pg. 53). Monthly average salinities also would remain similar under each alternative, with a maximum relative change of 1.2 percent. Consequently, monthly average salinities would not indicate changes in the ability to meet D-1641 compliance standards (Appendix F5, 4 vs. 1, pgs. 54 through 65). Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.6-17: Salinity changes in Old River at Tracy Road Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Old River at Tracy Road Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA Existing Condition during all months (Appendix F5, 4 vs. 1, pg. 66). Monthly average salinities would also be similar under each alternative, with a maximum relative change of 0.7 percent (Appendix F5, 4 vs. 1, pgs. 67 through 78). Consequently, monthly average salinities would comply with D-1641 standards. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.6-18: Salinity changes in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641. However this location is evaluated to address potential concerns related to the CCWD's water supply intake and potential impacts to water supplies associated with Los Vaqueros Reservoir.

Long-term average salinities at Highway 4 under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA Existing Condition during all months. Average salinities by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from 1.2 percent lower during September of wet years to 2.1 percent higher during August of dry years (Appendix F5, 4 vs. 1, pg. 79).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Modified Flow Alternative, compared to the CEQA Existing Condition, generally would occur during dry and critical years (**Table 9-108**). Monthly average salinities under the CEQA Modified Flow Alternative would be higher than salinities under the CEQA Existing Condition by up to about 9 percent (Appendix F5, 4 vs. 1, pgs. 80 through 91).

Table 9-108. Differences in Monthly Mean Salinity (µS/cm) in the Old River at Highway 4 (Los Vaqueros Intake), by Water Year Type, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	487	9	Feb (1)
Above Normal	---	---	---
Below Normal	---	---	---
Dry	410	7	Jun (1)
Critical	379-748	6-7	Feb (1), Jun (2), Jul (2)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-109**).

Table 9-109. Differences in Monthly Mean Salinity (µS/cm) in Old River at Highway 4 (CCWD Los Vaqueros Intake), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
Year	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	575	654	717	477	576	664	748	488	1 (0%)	10 (2%)	30 (4%)	10 (2%)
1987	646	573	629	375	641	524	589	368	-5 (-1%)	-49 (-9%)	-40 (-6%)	-7 (-2%)
1990	679	889	629	389	679	873	599	379	1 (0%)	-17 (-2%)	-29 (-5%)	-9 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-19: Salinity changes at CCWD Pumping Plant #1 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Sources of chlorides in Rock Slough include seawater, which intrudes into the Delta when freshwater outflow from the Delta is low, local drainage and seepage from adjacent lands, and the Sacramento and San Joaquin rivers. Seawater and local drainage are the primary concerns

(DWR 2003b). There are no applicable EC objectives for CCWD Pumping Plant #1 noted in D-1641. However this location is evaluated to address potential concerns related to the CCWD's water supply intake.

Long-term average salinities at CCWD Pumping Plant #1 under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA Existing Condition during all months. Average salinities by water year type under the CEQA Modified Flow Alternative would range from 1.5 percent lower during September of wet years to 2.2 percent higher during August of dry years (Appendix F5, 4 vs. 1, pg. 92).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA Modified Flow Alternative, compared to the CEQA Existing Condition, generally would occur during dry and critical years (**Table 9-110**). Monthly average salinities under the CEQA Modified Flow Alternative would be higher than salinities under the CEQA Existing Condition by up to 10 percent (Appendix F5, 4 vs. 1, pgs. 93 through 104).

Table 9-110. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, by Water Year Type, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	648	10	Feb (1)
Above Normal	---	---	---
Below Normal	---	---	---
Dry	337 - 343	5 - 7	Feb (1), Jun(1)
Critical	360 - 862	6 - 10	Jan (1), Feb (2), Jun (2), Jul (2)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-111**).

Table 9-111. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	641	743	825	535	642	753	862	546	1 (0%)	11 (1%)	37 (4%)	11 (2%)
1987	741	665	732	374	744	611	683	366	3 (0%)	-54 (-8%)	-48 (-7%)	-8 (-2%)
1990	733	1,036	707	402	734	1,019	672	393	1 (0%)	-17 (-2%)	-35 (-5%)	-9 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be

impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-20: Salinity changes in the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The applicable EC objective for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 1,000 µS/cm year-round.

Long-term average salinities at Clifton Court Forebay under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA Existing Condition during all months. Average salinities by water year type under the CEQA Modified Flow Alternative would range from 1.1 percent lower during September of wet years to 2.2 percent higher during August of dry years (Appendix F5, 4 vs. 1, pg. 105).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would be higher than salinities under the CEQA Existing Condition by up to 7.6 percent. Salinities under the CEQA Modified Flow Alternative, compared to those under the CEQA Existing Condition would be equal to or greater than five percent during 6 of the 192 months modeled (one occasion during February of wet years; one occasion during January and two occasions in both February and July of critical years). However, modeled salinities under both alternatives would not exceed the applicable EC objective of 1,000 µS/cm during any month (Appendix F5, 4 vs. 1, pgs. 106 through 117).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-112**).

Table 9-112. Differences in Monthly Mean Salinity (µS/cm) in the West Canal at the Mouth of Clifton Court Forebay (SWP Intake), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	524	601	680	563	524	607	700	571	0 (0%)	6 (1%)	20 (3%)	8 (1%)
1987	597	565	651	558	596	537	627	554	-1 (0%)	-28 (-5%)	-23 (-4%)	-5 (-1%)
1990	601	788	650	563	601	778	627	556	0 (0%)	-11 (-1%)	-23 (-4%)	-7 (-1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-21: Salinity changes in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The applicable EC objective for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 1,000 µS/cm year-round.

Long-term average salinities at Jones Pumping Plant under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA Existing Condition during all months. Average salinities by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from essentially equivalent during most months and water year types to 2.0 percent higher during August of dry years (Appendix F5, 4 vs. 1, pg. 118).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would be higher than salinities under the CEQA Existing Condition by up to 7.1 percent. Salinities under the CEQA Modified Flow Alternative, compared to those under the CEQA Existing Condition would be equal to or greater than five percent during 3 of the 192 months modeled (one occasion during June of a critical year; and two occasions during July of critical years). However, changes in monthly average salinities would not exceed monthly EC objectives.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-113**).

Table 9-113. Differences in Monthly Mean Salinity (µS/cm) in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

	Monthly Mean Salinity (µS/cm)											
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	533	609	689	597	533	614	706	605	0 (0%)	5 (1%)	17 (2%)	7 (1%)
1987	597	578	662	582	596	553	641	578	-1 (0%)	-25 (-4%)	-21 (-3%)	-4 (-1%)
1990	607	777	672	584	608	768	651	578	0 (0%)	-9 (-1%)	-21 (-3%)	-7 (-1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-22: Salinity changes at Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Middle River at Victoria Canal is an indicator of central Delta water quality and the water quality at Victoria Island agricultural siphons. There are no applicable EC objectives for Middle River at Victoria Canal noted in D-1641.

Long-term average salinities at Victoria Canal under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA Existing Condition during all months. Average salinities by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from essentially equivalent during most months and water year types to 2.0 percent higher during August of dry years (Appendix F5, 4 vs. 1, pg. 131). Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative would be higher than salinities under the CEQA Existing Condition by up to 6.5 percent (Appendix F5, 4 vs. 1, pgs. 132 through 143). Salinities under the CEQA Modified Flow Alternative would be equal to or greater than five percent during 3 of the 192 months modeled (two occasions during February and one occasion during July of a critical year types).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-114**).

Table 9-114. Differences in Monthly Mean Salinity (µS/cm) in Victoria Canal, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	397	468	547	461	398	471	563	469	0 (0%)	3 (1%)	16 (3%)	9 (2%)
1987	490	446	534	464	494	425	509	459	4 (1%)	-21 (-5%)	-25 (-5%)	-5 (-1%)
1990	448	609	563	419	448	603	543	410	0 (0%)	-6 (-1%)	-20 (-4%)	-9 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-23: Salinity changes at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns related to the City of Stockton's water supply intake.

Long-term average salinities at the Stockton Intake under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA Existing Condition during all months. Average salinities by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from essentially equivalent during most months and water year types to 1.8 percent higher during July and August of dry years (Appendix F5, 4 vs. 1, pg. 144).

Over the entire 16-year simulation period, monthly average salinities under the CEQA Modified Flow Alternative are higher than salinities under the CEQA Existing Condition by up to 6.1 percent (Appendix F5, 4 vs. 1, pgs. 145 through 156). Salinities under the CEQA Modified Flow Alternative would be equal to or greater than five percent, compared to the CEQA Existing Condition during 5 of the 192 months modeled (one occasions during January, February and July of critical years; and one occasion during both June and July of critical years).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-115**).

Table 9-115. Differences in Monthly Mean Salinity (µS/cm) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	360	421	490	354	360	428	508	360	0 (0%)	6 (2%)	18 (4%)	6 (2%)
1987	392	381	442	336	390	356	421	335	-3 (-1%)	-25 (-7%)	-20 (-5%)	-1 (0%)
1990	438	553	461	312	439	541	442	305	0 (0%)	-12 (-2%)	-18 (-4%)	-7 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-24: Changes in chloride concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objective for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations at Highway 4 under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from essentially equivalent in March and May to 0.6 percent higher during February and July. Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not exceed about 3 percent except during July of dry years when they would be 3.1 percent higher (Appendix F5, 4 vs. 1, pg. 157).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent would occur during 10 of the 192 months modeled. During these 10 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 6 occasions and lower on 4 occasions, relative to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA Modified Flow Alternative would be lower than the CEQA Existing Condition by ten percent during 1 of the 192 months and higher by ten percent or more (up to 11.0 percent) during 1 of the 192 months modeled (Appendix F5, 4 vs. 1, pgs. 158 through 169). Monthly average chloride ion concentrations from October through September are presented in **Table 9-116.**

Table 9-116. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake) from October Through September Over the 16-year Simulation Period Under the CEQA Modified Flow Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Modified Flow Alternative	127.8	102.6	102.5	89.8	66.5	44.5	37.0	42.6	47.4	56.2	96.3	128.5
CEQA Existing Condition	127.3	102.3	102.3	87.7	66.1	44.5	37.0	42.6	47.3	55.9	95.8	128.3

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-117**).

Table 9-117. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	114	136	154	60	114	139	163	61	0 (0%)	3 (2%)	9 (6%)	2 (3%)
1987	134	113	129	44	133	99	76	43	-1 (-1%)	-14 (-12%)	-53 (-41%)	-1 (-3%)
1990	143	203	82	46	144	199	78	45	0 (0%)	-5 (-2%)	-4 (-5%)	-1 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-25: Changes in chloride concentrations in CCWD Pumping Plant #1 (Rock Slough) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for CCWD Pumping Plant #1 (Rock Slough) is 150 mg/l year round.

Long-term average chloride ion concentrations at CCWD Pumping Plant #1 (Rock Slough) under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from essentially equivalent in March, May, and September to 0.4 percent higher in October, July, and August. Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not exceed about 3 percent (Appendix F5, 4 vs. 1, pg. 170).

Over the entire 16-year simulation period, monthly average chloride concentrations would exceed 150 mg/l under both the CEQA Modified Flow Alternative and CEQA Existing Condition 43 of the 192 months modeled. During those 43 months when chloride ion concentrations exceeded 150 mg/l, concentrations would be higher under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative by 0.1 percent to 10.7 percent on 21 occasions, and lower by 0.1 percent to 2.3 percent on 16 occasions (Appendix F5, 4 vs. 1, pgs. 171 through 182). Monthly average chloride ion concentrations from October through September are presented in **Table 9-118**.

Temporal patterns in chloride ion concentrations under the CEQA Modified Flow Alternative in the Delta over the 16-year simulation period are dependent on modeling assumptions and real-time operations in the Yuba River Basin.

Table 9-118. Monthly Mean Chloride Ion Concentrations (mg/l) CCWD Pumping Plant #1 (Rock Slough) from October Through September Over the 16-year Simulation Period Under the CEQA Modified Flow Alternative and the CEQA Existing Condition

	Monthly Average Chloride Ion Concentration (mg/l)											
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
CEQA Modified Flow Alternative	155.0	124.4	119.4	109.6	87.7	64.6	58.3	43.2	44.7	69.1	120.4	153.2
CEQA Existing Condition	154.4	124.1	119.2	109.4	87.5	64.6	58.2	43.2	44.7	68.8	119.9	153.1

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-119**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Table 9-119. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at CCWD Pumping Plant #1 (Rock Slough), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	114	134	143	89	114	137	149	91	0 (0%)	2 (2%)	7 (5%)	2 (3%)
1987	161	135	124	56	161	123	114	54	0 (0%)	-12 (-9%)	-10 (-8%)	-2 (-3%)
1990	156	188	117	63	157	184	110	61	0 (0%)	-4 (-2%)	-6 (-5%)	-2 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.6-26: Changes in chloride concentrations in Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives for Old River at Rock Slough (CCWD Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations in Old River at Rock Slough under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from 0.1 percent lower in March to 0.6 percent higher in February and July. Differences in average chloride ion concentration by water year type do not exceed 3 percent except during July of dry years when they would be approximately 3.3 percent higher, and during August of wet years when they would be 3.6 percent lower under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F5, 4 vs. 1, pg. 183).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent would occur during 12 of the 192 months modeled. During these 12 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 7 occasions and lower on 5 occasions, relative to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA Modified Flow Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 11.3 percent) during 1 of the 192 months modeled and higher by ten percent or more (up to 10.9 percent) during 2 of the 192 months modeled (Appendix F5, 4 vs. 1, pgs. 184 through 195). Monthly average chloride ion concentrations from October through September are presented in **Table 9-120**.

Table 9-120. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Rock Slough (CCWD Intake) from October Through September Over the 16-year Simulation Period Under the CEQA Modified Flow Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Modified Flow Alternative	144.6	112.5	115.0	92.7	63.5	36.0	28.8	33.2	35.6	65.1	119.1	156.0
CEQA Existing Condition	144.0	112.2	114.9	92.5	63.2	36.0	28.8	33.2	35.6	64.7	118.5	155.8

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see

Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-121**).

Table 9-121. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Rock Slough (CCWD Intake), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	136	157	169	56	136	161	180	58	0 (0%)	4 (3%)	10 (6%)	1 (3%)
1987	153	126	131	32	149	109	77	31	-4 (-2%)	-18 (-14%)	-54 (-41%)	-1 (-3%)
1990	178	231	80	38	178	224	75	37	0 (0%)	-7 (-3%)	-5 (-6%)	-1 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-27: Changes in chloride concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from essentially equivalent in March and May to 0.7 percent higher in July. Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not exceed about 2 percent except during July and August of dry years when they would be 2.6 percent and 3.1 percent higher .(Appendix F5, 4 vs. 1, pg. 196).

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 250 mg/l under either the CEQA Modified Flow Alternative or the CEQA Existing Condition. However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 5 of the 192 months modeled. During these 5 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 3 occasions and lower on 2 occasions, relative to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA Modified Flow Alternative would be lower than the CEQA Existing Condition by ten percent or more and higher by ten percent or more (up to 11.0 percent) during 1 of the 192 months modeled (Appendix F5, 4 vs. 1, pgs. 197 through 208). Monthly average chloride ion concentrations from October through September are presented in **Table 9-122**.

Table 9-122. Monthly Mean Chloride Ion Concentrations (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant) from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA No Project Alternative	101.0	86.8	82.8	74.6	58.2	44.9	38.8	41.1	47.2	46.9	70.5	96.3
CEQA Existing Condition	100.6	86.6	82.6	74.5	57.9	44.9	38.7	41.1	47.1	46.6	70.3	96.2

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-123**).

Table 9-123. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	86	105	124	63	86	107	130	65	0 (0%)	1 (1%)	6 (5%)	2 (3%)
1987	107	94	113	58	108	85	75	57	1 (1%)	-8 (-9%)	-38 (-33%)	-1 (-2%)
1990	102	157	85	53	102	154	81	51	0 (0%)	-3 (-2%)	-4 (-5%)	-2 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-28: Changes in chloride concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from essentially equivalent in January, March, and May to 0.7 percent higher in July. Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not exceed approximately 2 percent except during July and August of dry year when they would be 2.4 percent and 2.8 percent higher (Appendix F5, 4 vs. 1, pg. 209).

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 250 mg/l under either the CEQA Modified Flow Alternative or the CEQA Existing Condition. However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 5 of the 192 months modeled. During these 5 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 3 occasions and lower on 2 occasions, relative to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA Modified Flow Alternative would be higher by ten percent or more (up to 10.1 percent) during 1 of the 192 months modeled (Appendix F5, 4 vs. 1, pgs. 210 through 221). Monthly average chloride ion concentrations from October through September are presented in **Table 9-124**.

Table 9-124. Monthly Mean Chloride Ion Concentrations (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) from October Through September Over the 16-year Simulation Period Under the CEQA Accord Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Modified Flow Alternative	101.6	86.8	87.5	79.5	67.5	60.2	45.6	43.7	54.5	55.3	82.5	110.7
CEQA Existing Condition	101.2	86.5	87.5	79.4	67.4	60.1	45.6	43.7	54.4	54.9	82.0	110.6

Temporal patterns in chloride ion concentrations under the CEQA Modified Flow Alternative in the Delta over the 16-year simulation period are dependent on modeling assumptions and real-time operations in the Yuba River Basin.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-125**).

Table 9-125. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	93	111	131	78	93	113	135	79	0 (0%)	1 (1%)	4 (3%)	1 (1%)
1987	108	104	124	75	108	97	84	75	0 (0%)	-6 (-6%)	-40 (-32%)	-1 (-1%)
1990	111	152	89	76	111	150	86	75	0 (0%)	-2 (-1%)	-3 (-4%)	-1 (-1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-29: Changes in chloride concentrations in Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives in Middle River at Victoria Canal noted in D-1641. However, Middle River at Victoria Canal is an indicator of central Delta water quality and water quality at the Victoria Island agricultural siphons, and is therefore evaluated.

Long-term average chloride ion concentrations in Middle River at Victoria Canal under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from essentially equivalent in January and May to 1.1 percent higher in July. Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition do not exceed approximately 3 percent except during August of dry years when they would be 3.2 percent higher (Appendix F5, 4 vs. 1, pg. 222).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent would occur during 5 of the 204 month modeled. During these 5 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 3 occasions and lower on 2 occasions, relative to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA Modified Flow Alternative would be higher by ten percent or more (up to 11.3) during 1 of the 192 months modeled (Appendix F5, 4 vs. 1, pgs. 223 through 234). Monthly average chloride ion concentrations from October through September are presented in **Table 9-126**.

Table 9-126. Monthly Mean Chloride Ion Concentrations (mg/l) in Middle River at Victoria Canal from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Modified Flow Alternative	76.3	70.2	63.4	62.3	55.1	46.0	41.7	48.8	54.9	40.0	50.4	67.2
CEQA Existing Condition	76.0	70.0	63.3	62.3	55.0	46.0	41.6	48.7	54.8	39.5	49.9	67.1

Temporal patterns in chloride ion concentrations under the CEQA Modified Flow Alternative in the Delta over the 16-year simulation period are dependent on modeling assumptions and real-time operations in the Yuba River Basin.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-127**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Table 9-127. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Middle River at Victoria Canal, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	59	76	95	57	59	77	99	58	0 (0%)	1 (1%)	4 (4%)	1 (2%)
1987	82	71	92	58	83	66	64	57	1 (1%)	-5 (-7%)	-28 (-30%)	-1 (-1%)
1990	71	111	72	51	71	109	69	49	0 (0%)	-2 (-1%)	-3 (-4%)	-1 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.6-30: Changes in chloride concentrations at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives at the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns associated with the City of Stockton's water supply intake.

Long-term average chloride ion concentrations at the Stockton Intake under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would range from essentially equivalent in May to 1.3 percent higher in July. Differences in average chloride ion concentration by water year type under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not exceed approximately 4 percent except during July of dry years when they would be 4.1 percent higher (Appendix F5, 4 vs. 1, pg. 235).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent would occur during 10 of the 204 month modeled. During these 10 months, chloride ion concentrations would be higher under the CEQA Modified Flow Alternative on 7 occasions and lower on 3 occasions, relative to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA Modified Flow Alternative would be higher by ten percent or more (up to 11.0) during 1 of the 192 months modeled (Appendix F5, 4 vs. 1, pgs. 236 through 247). Monthly average chloride ion concentrations from October through September are presented in **Table 9-128**.

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent would not occur. Monthly average chloride ion concentrations from October through September are presented in Table 9-128.

Table 9-128. Monthly Mean Chloride Ion Concentrations (mg/l) at the Stockton Intake from October Through September Over the 16-year Simulation Period Under the CEQA Modified Flow Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA Modified Flow Alternative	57.8	50.5	46.1	45.7	39.6	32.2	36.4	44.2	33.0	26.8	38.2	450.3
CEQA Existing Condition	57.4	50.4	46.0	45.6	39.5	32.1	36.3	45.2	32.7	26.5	37.9	50.2

Temporal patterns in chloride ion concentrations under the CEQA Modified Flow Alternative in the Delta over the 16-year simulation period are dependent on modeling assumptions and real-time operations in the Yuba River Basin.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-129**).

Table 9-129. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the CEQA Modified Flow Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	50	65	82	41	50	66	86	42	0 (0%)	2 (2%)	4 (5%)	1 (2%)
1987	58	55	70	38	57	49	51	38	-1 (-1%)	-6 (-11%)	-19 (-27%)	0 (-1%)
1990	69	97	57	35	69	94	54	34	0 (0%)	-3 (-3%)	-3 (-5%)	-1 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-31: Changes in DOC concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no DOC objectives noted in D-1641 for any location within the Delta. However, consideration of data regarding the average DOC concentrations in the Delta, assumed levels of natural variation, and assumed relationships between DOC concentrations and THM formation in drinking water has resulted in establishment of a monthly change significance criterion for DOC of 0.4 mg/l (see Section 9.2.2.1).

Long-term average DOC concentrations and average DOC concentrations by water year type at Highway 4 under the CEQA Modified Flow Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types (Appendix F5, 4 vs. 1, pg. 248). Monthly average DOC concentrations would also be equivalent under each alternative, with no modeled changes occurring between the alternative and the basis of comparison (Appendix F5, 4 vs. 1, pgs. 249 through 260). Consequently, changes in the monthly average DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact to Delta water quality.

Impact 9.2.6-32: Changes in DOC concentrations in Old River at Rock Slough (CCWD Intake) DOC concentrations that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations and average DOC concentrations by water year type in Old River at Rock Slough under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types (Appendix F5, 4 vs. 1, pg. 261). Monthly average DOC concentrations also would be equivalent under each alternative (Appendix F5, 4 vs. 1, pgs. 262 through 273). Consequently, changes in the monthly average DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.6-33: Changes in DOC concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations and average DOC concentrations by water year type at Clifton Court Forebay under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types (Appendix F5, 4 vs. 1, pg. 274). Monthly average DOC concentrations also would be similar under each alternative, with a maximum absolute change of 0.1 mg/l (Appendix F5, 4 vs. 1, pgs. 275 through 286). Consequently, changes in the monthly average DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact Delta water quality.

Impact 9.2.6-34: Changes in DOC concentrations in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average DOC concentrations and average DOC concentrations by water year type at the Jones Pumping Plant under the CEQA Modified Flow Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types (Appendix F5, 4 vs. 1, pg. 287). Monthly average DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.1 mg/l (Appendix F5, 4 vs. 1, pgs. 288 through 299). Consequently, changes in the monthly average DOC concentrations would not exceed significance criteria, and therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact Delta water quality.

Impact 9.2.6-35: Changes in monthly mean flows in the Old River at Bacon Island that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Old River at Bacon Island under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not exceed approximately 1 percent. The direction of flow under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would move towards the Delta pumps during all months and water years except during February through April of wet years. The magnitude of flows moving towards Delta pumps during February through May of all water years would be essentially equivalent or reduced during most months and water years under the CEQA Modified Flow Alternative (Appendix F5, 4 vs. 1, pg. 300). In general, the magnitude of flows moving towards Delta pumps under the CEQA Modified Flow Alternative during all years is slightly lower.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 38 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 154 months (Appendix F5, 4 vs. 1, pgs. 301 through 312).

Overall, potential changes in monthly mean flows under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-36: Changes in monthly mean flows in the Middle River at Middle River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Middle River at Middle River under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not exceed about 1 percent over the 16-year simulation period. The direction of flow under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would move towards the Delta pumps during all months and water years. The magnitude of flows moving towards Delta pumps under the CEQA Modified Flow Alternative during February through May would be reduced, and essentially equivalent, relative to the CEQA Existing Condition during most months and water years except during dry years. The rate of flow movement towards Delta pumps would be up to about 25 cfs higher during February under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F5, 4 vs. 1, pg. 313). In general, the magnitude of flows moving towards Delta pumps under the CEQA Modified Flow Alternative would be between about 4 cfs and about 90 cfs lower from June through November of wet, above normal, below normal and dry years, relative to the CEQA Existing Condition.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 38 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 154 months (Appendix F5, 4 vs. 1, pg. 314 through 325).

Overall, potential changes in monthly mean flows under the CEQA Yuba Accord Alternative, compared to the CEQA No Project Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-37: Changes in monthly mean flows in the Middle River at Mowry Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Middle River at Mowry Bridge are essentially equivalent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition over the 16-year simulation period. The direction of flow under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be essentially equivalent during most months and water years (Appendix F5, 4 vs. 1, pg. 326). Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.6-38: Decreases in San Luis Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Historically, the CVP and SWP have cooperated to try to maintain San Luis Reservoir above 300 TAF in response to the low-point problem and thus, avoid adverse impacts to water quality. Long-term average monthly combined CVP and SWP reservoir storage and average monthly reservoir storage by water year type under the CEQA Modified Flow Alternative would be essentially equivalent in San Luis Reservoir, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pg. 1339 and 1376). In addition, there would be no additional months under the CEQA Modified Flow Alternative when the combined CVP and SWP monthly mean reservoir storage drops below 300 TAF (Appendix F4, 4 vs. 1, pgs. 1340 through 1351 and 1377 through 1388). Therefore, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in San Luis Reservoir.

9.2.7 Environmental Impacts/Environmental Consequences of the CEQA No Project/CEQA No Action Alternative Compared to the CEQA Existing Condition/NEPA Affected Environment

As discussed in Chapter 3, the key elements and activities (e.g., implementation of the RD-1644 Long-term instream flow requirements) for the CEQA No Project Alternative would be the same for the NEPA No Action Alternative. The primary differences between the CEQA No Project and NEPA No Action alternatives are various hydrologic and other modeling assumptions (see Section 4.5 and Appendix D). Because of these differences between the No Project and No Action alternatives, these alternatives are distinguished as separate alternatives for CEQA and NEPA evaluation purposes.

Based on current plans and consistent with available infrastructure and community services, the CEQA No Project Alternative in this EIR/EIS is based on current environmental conditions (e.g., project operations, water demands, and level of land development) plus potential future operational and environmental conditions (e.g., implementation of the RD-1644 Long-term instream flow requirements in the lower Yuba River) that probably would occur in the foreseeable future in the absence of the Proposed Project/Action or another action alternative. The NEPA No Action Alternative also is based on conditions without the proposed project, but uses a longer-term future timeframe that is not restricted by existing infrastructure or physical and regulatory environmental conditions. The differences between these modeling characterizations and assumptions for the CEQA No Project and the NEPA No Action alternatives, including the rationale for developing these two different scenarios for this EIR/EIS, are explained in Chapter 4[44].

Although implementation of the RD-1644 Long-term instream flow requirements would occur under both the CEQA No Project and the NEPA No Action alternatives, the resultant model outputs for both scenarios are different because of variations in the way near-term and long-term future operations are characterized for other parameters in the CEQA and NEPA assumptions. As discussed in Chapter 4, the principal difference between the CEQA No Project Alternative and the NEPA No Action Alternative is that the NEPA No Action Alternative

[44] For modeling purposes related to CEQA analytical requirements, OCAP Study 3 (2001 level of development) is used as the foundational study upon which the modeling scenarios for the CEQA No Project Alternative and the CEQA Existing Condition were developed. For modeling purposes related to NEPA analytical requirements, OCAP Study 5 (2020 level of development) is used as the foundational study upon which the modeling scenarios for the NEPA No Action Alternative was developed.

includes several potential future water projects in the Sacramento and San Joaquin valleys (e.g., CVP/SWP Intertie, FRWP, SDIP and a long-term EWA Program or a program equivalent to the EWA), while the CEQA No Project Alternative does not. Because many of the other assumed conditions for these two scenarios are similar, the longer-term analysis of the NEPA No Action Alternative compared to the NEPA Affected Environment builds upon the nearer-term analysis of the CEQA No Project Alternative compared to the CEQA Existing Condition.

Because the same foundational modeling base (OCAP Study 3) was used to characterize near-term conditions (2001 level of development) both the CEQA No Project Alternative and the CEQA Existing Condition, it was possible to conduct a detailed analysis to quantitatively evaluate the hydrologic changes in the Yuba Region and the CVP/SWP system that would be expected to occur under these conditions. Building on the CEQA analysis, the analysis of the NEPA No Action Alternative compared to the NEPA Affected Environment consists of two components: (1) an analysis of near-term future without project conditions quantified through the CEQA No Project Alternative, relative to the CEQA Existing Condition; and (2) a qualitative analysis of longer-term future without project conditions (the NEPA No Action alternative)[45].

9.2.7.1 CEQA No Project Alternative Compared to the CEQA Existing Condition

Impact 9.2.7.1-1: Decreases in New Bullards Bar Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year simulation period, differences in long-term average end-of-month monthly storage and reservoir storage by water year type under the CEQA No Project Alternative relative to the CEQA Existing Condition would be up to 11 percent higher under the CEQA No Project Alternative, except during critical water years during which reservoir storage would be 4 percent to 12 percent lower from May through September (Appendix F4, 2 vs. 1, pg. 1). During months when reservoir storage volumes would typically be lowest[46], average differences in reservoir storage under the CEQA No Project Alternative would range from about 5 percent higher in August to about 6 percent higher in October and November. Differences during all other months would not exceed about 6 percent. During all months reservoir storage under the CEQA No Project Alternative, relative to the CEQA Existing Condition would be essentially equivalent[47] and higher at least 75 percent of the time, over the monthly cumulative reservoir storage distributions, except during June during when storage would be lower about 40 percent of the time, and essentially equivalent the rest of the time. During the lowest reservoir storage conditions[48] occurring in October and November, reservoir storage under the CEQA No Project Alternative is on average about 10 percent lower 80 percent to 100 percent of the time.

The frequency and magnitude of changes in storage would not be sufficient to reduce the long-term water quality in New Bullards Bar Reservoir due to the morphology of the reservoir. Therefore, the CEQA No Project Alternative, compared to the CEQA Existing Condition, would result in less than significant impacts to water quality in New Bullards Bar Reservoir.

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[45] The second analytical component cannot be evaluated quantitatively due to the differences in the underlying baseline assumptions for OCAP Study 3 and OCAP Study 5.

[46] Generally, ranging from August through September in New Bullards Bar Reservoir.

[47] Essentially equivalent refers to relative differences in storage volume between the alternative and the basis of comparison that are less than 1 percent.

[48] The lowest 25 percent of the cumulative probability storage distribution.

Impact 9.2.7.1-2: Changes in monthly mean flows in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

During the seasonal high flow period (i.e., December through June), long-term average flows in the lower Yuba River at Smartville would range from about 11 percent higher in December, to about 2 percent lower in May under the CEQA No Project Alternative, relative to the CEQA Existing Condition, over the 72-year simulation period (Appendix F4, 2 vs. 1, pg. 100). During the seasonal low flow period[49], long-term average flows in the lower Yuba River at Smartville would range from approximately 22 percent lower in August to approximately 10 percent higher in November under the CEQA No Project Alternative. Maximum decreases in average monthly flow under the CEQA No Project Alternative would range from about 26 percent to 31 percent and occur during July and August of above normal water years. During critical water years, flows under the CEQA No Project Alternative would be generally higher by about 2 percent to about 50 percent. During typically low flow conditions occurring from August through November, flows under the CEQA No Project Alternative would be on average about 5 percent to 20 percent higher, relative to the CEQA Existing Condition about 40 percent to 100 percent of the time.

During the seasonal high flow period[50], long-term average flows in the lower Yuba River at Marysville would range from approximately 2 percent lower in March to approximately 10 percent higher in December under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pg. 272). During the seasonal low flow period, long-term average flows in the lower Yuba River at Marysville would range from approximately 40 percent lower in August to approximately 11 percent higher in November under the CEQA No Project Alternative. Maximum decreases in average monthly flow under the CEQA No Project Alternative would range from about 60 percent to 50 percent, and occur during July and August of below normal water years. During typically low flow conditions occurring from August through November, flows under the CEQA No Project Alternative in August would be higher on average by 100 percent about 25 percent of the time; higher on average by 30 percent 100 percent of the time in September; essentially equivalent 50 percent of the time in October; and higher by 5 percent on average in November about 10 percent of the time.

Overall, changes in lower Yuba River flows under the CEQA No Project Alternative would not result in any long-term impacts to designated beneficial uses, existing regulatory standards, degradation of general water quality. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Yuba River.

Impact 9.2.7.1-3: Changes in monthly mean water temperatures in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year period of simulated long-term average water temperatures under the CEQA No Project Alternative, relative to the CEQA Existing Condition, in the lower Yuba River at Smartville are essentially equivalent[51] during all months except July during which water temperatures are 0.4°F higher (Appendix F4, 2 vs. 1, pg. 174). Long-term average water temperatures at Marysville under the CEQA No Project Alternative would be essentially

[49] Generally, ranging from August through November in the lower Yuba River.

[50] Generally, ranging from December through June in the lower Yuba River.

[51] Essentially equivalent refers to water temperature differences between the alternative and the basis of comparison that are equal to or greater than 0.3 °F.

equivalent during most months with the exception of May through September when water temperatures would be 0.7ºF lower and would range from 56.5ºF to 60.0ºF during May and June; and 2.5ºF, 2.1ºF, and 0.4ºF higher July through September. Average monthly water temperatures by water year type under the CEQA No Project Alternative would be essentially equivalent during most months and water years. During the July through September period of all water years, water temperatures would be higher by up to approximately 5ºF, however they would not exceed 65ºF, compared to water temperatures under the CEQA Existing Condition, which reach a maximum of about 67ºF in June of critical water years.

Long-term average water temperatures at Daguerre Point Dam during the April through July period would be essentially equivalent during most months with the exception of July, when they would be 1.0ºF higher, relative to the CEQA Existing Condition. However, water temperatures during these times would not exceed about 58ºF under either alternative. Average monthly water temperatures during all water years under the CEQA No Project Alternative at Daguerre Point Dam would be essentially equivalent to the CEQA Existing Condition and generally would remain below 60ºF. There would be one occurrence over the 72-year period of simulation under the CEQA No Project Alternative, relative to the CEQA Existing Condition, during which monthly mean water temperatures during July exceed 65ºF by approximately 1ºF (Appendix F4, 2 vs. 1, pg. 248 through 259).

Overall, lower Yuba River water temperatures under the CEQA No Project Alternative would be similar to the CEQA Existing Condition. Water temperature changes in the lower Yuba River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Yuba River.

Impact 9.2.7.1-4 Decreases in Oroville Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly reservoir storage and average monthly reservoir storage by water year type under the CEQA No Project Alternative would be essentially equivalent in Oroville Reservoir, relative to the CEQA Existing Condition over the 72-year simulation period (Appendix F4, 2 vs. 1 pg. 406). The cumulative reservoir storage distributions for all months, under the CEQA No Project Alternative would be essentially equivalent, relative to the CEQA Existing Condition, about 90 percent of the time (Appendix F4, 2 vs. 1 pg. 431 through 442). Therefore, the CEQA Yuba Accord Alternative, compared to the CEQA Existing Condition would have a less than significant impact on water quality in Oroville Reservoir.

Impact 9.2.7.1-5: Changes in monthly mean flows in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly flows or average monthly flows by water year type in the Feather River below the Fish Barrier Dam under the CEQA No Project Alternative, relative to the CEQA Existing Condition.

Differences in long-term average monthly flows in the Feather River below the Thermalito Afterbay Outlet under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would not exceed approximately 2 percent over the 72-year simulation period. Differences in long-term average monthly flows in the Feather River at the mouth under the CEQA No Project Alternative would not exceed approximately 8 percent. Decreases in average monthly flow below the Thermalito Afterbay Outlet and at the mouth of the Feather River would range from 1 percent lower to approximately 14 percent lower during all water years (Appendix F4, 2 v. 1. pg. 603).

During typically low flow conditions below the Thermalito Afterbay Outlet occurring from September through November, flows under the CEQA No Project Alternative are essentially equivalent about 80 percent to 100 percent of the time. During low flow conditions at the mouth of the Feather River from September through November, flows under the CEQA No Project Alternative are lower by about 5 percent about 55 percent to 70 percent of the time (Appendix F4, 3 v. 1. pg. 800 through 811).

Overall, lower Feather River flows under the CEQA Yuba Accord Alternative would not substantially change compared to the CEQA Existing Condition and, thus, would not be expected to degrade water quality or adversely affect beneficial uses. Therefore, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Feather River.

Impact 9.2.7.1-6: Changes in monthly mean water temperatures in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type in the lower Feather River below the Thermalito Afterbay under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would be essentially equivalent (Appendix F4, 2 vs. 1, pg. 677). Long-term average water temperatures at the mouth of the Feather River would be essentially equivalent except during July and August when they would be 0.6°F and 0.9°F higher, relative to the CEQA Existing Condition. Average monthly water temperatures by water year type below the Thermalito Afterbay would be essentially equivalent during all months and water years. Average monthly water temperatures by water year type at the mouth of the Feather River under the CEQA No Project Alternative would range from 0.5°F to 1.3°F higher during July and August of all except critical water years. However, water temperatures during these times would not exceed 73.5°F. During critical water years water temperatures would be essentially equivalent for all months except May and June during which they are 0.6°F and 0.4°F lower under the CEQA No Project Alternative.

Water temperatures below the Thermalito Afterbay Outlet would be essentially equivalent during all months under the CEQA No Project Alternative, relative to the CEQA Existing Condition, about 90 percent to 100 percent of the time over the cumulative water temperature distribution (Appendix F4, 2 v. 1. pg. 628 through 639). At the mouth of the Feather River, water temperatures under the CEQA No Project Alternative would be essentially equivalent about 95 percent to 100 percent of the time during all months of the cumulative water temperature distribution with the exception of May, July and August (Appendix F4, 3 v. 1. pg. 849 through 860). During May water temperatures would be essentially equivalent about 70 percent of the time and lower by an average of 0.6°F about 30 percent of the time. During July, water temperatures under the CEQA No Project Alternative would be essentially equivalent about 10 percent of the time and higher by an average of 0.7°F resulting in water temperatures in the range of 70°F to 78°F, compared to a range of 69°F to 77°F, under the CEQA Existing Condition.

Overall, lower Feather River water temperatures under the CEQA No Project Alternative would be similar to the CEQA Existing Condition. Water temperature changes occurring in the lower Feather River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the CEQA No

Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in the lower Feather River.

Impact 9.2.7.1-7: Changes in monthly mean flows in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Sacramento River below the confluence with the Feather River (Appendix F4, 2 vs. 1, pg. 882) and at Freeport (Appendix F4, 2 vs. 1, pg. 1005) under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would not exceed about 4 percent. Differences in average monthly flows below the Feather River confluence and at Freeport do not exceed approximately 6 percent during all water years.

Flows in the Sacramento River below the Feather River confluence and (Appendix F4, 2 vs. 1, pg. 907 through 918) at Freeport (F4, 2 vs. 1, pg. 1030 through 1041) under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would be essentially equivalent during most months about 45 percent to 90 percent of the time over the cumulative flow distribution. During July and August, flows are lower 90 percent of the time under the CEQA No Project Alternative; however; the average flow decrease during these times would be less than about 5 percent, relative to the CEQA Existing Condition. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than a significant impact on water quality in the Sacramento River.

Impact 9.2.7.1-8: Changes in monthly mean water temperatures in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year period of simulation, long-term average monthly water temperatures under the CEQA No Project Alternative, relative to the CEQA Existing Condition, in the Sacramento River below the Feather River confluence would be essentially equivalent (Appendix F4, 2 vs. 1, pg. 956). Differences in average monthly water temperatures by water year type during all months below the confluence with the Feather River do not exceed 0.4ºF, and would remain below 73ºF under the CEQA No Project Alternative. Long-term average monthly water temperatures and average monthly water temperatures by water year type at Freeport are essentially equivalent, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pg. 1054).

Water temperatures below the Feather River confluence (Appendix F4, 3 vs. 1, pg. 907 through 918) and at Freeport (Appendix F4, 3 vs. 1, pg. 1079 through 1090) would be essentially equivalent during most months under the CEQA No Project Alternative approximately 95 percent to 100 percent of the time over the cumulative water temperature distribution . Water temperatures during July and August below the Feather River confluence under the CEQA No Project Alternative would be essentially equivalent 40 percent to 70 percent of the time, and higher on average by about 0.4ºF, relative to t he CEQA Existing Condition, However, water temperatures during these times generally do not exceed 75 ºF.

Overall, the frequency and magnitude of changes under the CEQA No Project Alternative, compared to the CEQA Existing Condition, would have a less than a significant impact on water temperatures in the Sacramento River.

Impact 9.2.7.1-9: Changes to the monthly mean location of X2 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The location of the estuarine salinity gradient is regulated during the months of February through June by the location of X2 objective in the 1995 WQCP (D-1641). The X2 location must remain downstream of the Confluence of the Sacramento and San Joaquin rivers[52] (River Kilometer 81, located upstream from the Golden Gate Bridge) for the entire 5-month period. The X2 objective also specifies the number of days each month that that location of X2 must be downstream of Chipps Island (RK 74) or downstream of Roe Island[53] (RK 64). However, due to DSM2 modeling limitations these two locations are not evaluated (see Section 9.2.1.2)

During all months of the year, the long-term average and average location of X2 by water year would be essentially equivalent during most months under CEQA No Project Alternative, compared to the CEQA Existing Condition. The average X2 location under the CEQA No Project Alternative would shift up to 0.2 km downstream and up to 0.1 km upstream during some months (Appendix F4, 2 vs. 1, pg. 1189).

The monthly mean X2 location from February through June under the CEQA No Project Alternative and the CEQA Existing Condition are presented in **Table 9-130**. There would be two additional less occurrences under the CEQA No Project Alternative in February when the monthly mean X2 location would be upstream of river kilometer 81. The magnitude of the upstream shift in X2 location under the CEQA Existing Condition would range from 0.1 KM in critical years to 1.2 KM in below normal years (Appendix F4, 2 vs. 1, pg. 1214 through 1225).

Table 9-130. Monthly Mean X2 Location (RK) from February Through June Over the 72-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Mean X2 Location (RK)					
Alternative	Feb	Mar	Apr	May	Jun
CEQA No Project Alternative	71.5	66.5	66.0	67.9	70.1
CEQA Existing Condition	71.3	66.4	66.0	67.9	70.0

Delta outflow objectives established in SWRCB D-1641 extend throughout the year. For the February though June period under the CEQA Yuba Accord Alternative, Delta outflow objectives are met by compliance with the X2 objective. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Overall, the slight changes in the monthly mean X2 location under the CEQA No Project Alternative, compared to the CEQA Existing Condition, would not be of sufficient magnitude or frequency to adversely impact water quality resources in the Delta. Therefore, the CEQA No Project Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact on the X2 location.

Impact 9.2.7.1-10: Changes to monthly mean Delta outflow that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Delta outflow objectives established in SWRCB D-1641 extend throughout the year. For the February though June period, Delta outflow objectives are met by compliance with the X2 objective. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Over the entire 72-year period of simulated October through September outflows, long-term average Delta outflow would be essentially equivalent under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pg. 1140). Average monthly flows by water year type under both the CEQA No Project Alternative and the CEQA Existing Condition would meet minimum outflow requirements, as defined in the SWRCB D-1641. Differences in average monthly flows

[52] Also referred to as Collinsville.

[53] Also referred to as the Port Chicago EC monitoring station.

between the CEQA No Project Alternative and the CEQA Existing Condition would not exceed 4 percent. Overall, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.7.1-11: Changes to monthly mean E/I ratios that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The Delta E/I ratio limits, established in SWRCB D-1641, specify that up to 35 percent of Delta inflows may be exported during the February through June period, and up to 65 percent of Delta inflows may be exported during the remaining months (i.e., July through January). These limits would be consistently met under both the CEQA No Project Alternative and the CEQA Existing Condition (Appendix F4, 2 vs. 1, pg. 1238). Therefore, the CEQA No Project Alternative, compared to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.7.1-12: Salinity changes in the Sacramento River at Emmaton that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Emmaton during the April through August period range from 450 to 2,780 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Emmaton under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 6.3 percent lower in June to 3.7 percent higher in August. Average salinities by water year type would decrease by five percent or more (up to 8.3 percent) during May and June of dry and critical years. In addition, average salinities by water year type would increase by five percent or more (up to 17.0 percent) during July and August of above normal, below normal and dry years, and September of below normal years (Appendix F5, 2 vs. 1, pg. 1) .

Over the entire 16-year simulation period, monthly average salinities under the CEQA No Project Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 18.9 percent) during 8 of the 192 months modeled, and higher by ten percent or more (up to 23.3 percent) during 8 of the 192 months modeled. As a result of the increases in monthly average salinities under the CEQA No Project Alternative, modeled EC values between April and August would not comply with D-1641 standards 3 additional times (1 below normal, 1 dry, and 1 critical year in August), relative to the CEQA Existing Condition. During the 18 modeled months in which neither alternative would comply with D-1641 standards, EC conditions would measurably improve (by up to 14.4 percent) under the CEQA No Project Alternative during 5 months, and measurably decline (by up to 23.3 percent) during 10 months (Appendix F5, 2 vs. 1, pg. 2 through 13).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA No Project Alternative, compared to the CEQA Existing Condition, would occur during all water years (**Table 9-131**).

Table 9-131. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, by Water Year Type, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	342 - 1,016	6 - 10	Jan (1), Jul (1), Aug (1)
Above Normal	463 - 2,677	9 - 23	Oct (1), Jul (1), Aug (2), Sep (1)
Below Normal	521 – 2,732	8 - 15	Jul (1), Aug (1), Sep (1)
Dry	343 – 2,149	6 - 12	Oct (1), Mar (1), Jul (2), Aug (2)
Critical	3,166	6	Aug (2)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-132**).

Table 9-132. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,073	1,195	887	410	1,059	1,236	895	411	-14 (-1%)	41 (3%)	7 (1%)	1 (0%)
1987	1,964	1,210	455	188	2,128	1,321	456	188	164 (8%)	110 (9%)	1 (0%)	0 (0%)
1990	1,828	932	424	544	1,811	880	402	532	-17 (-1%)	-52 (-6%)	-22 (-5%)	-13 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-13: Salinity changes in the San Joaquin River at Jersey Point that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Jersey Point during the April through August period range from 450 to 2,200 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Jersey Point under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 4.1 percent lower in June to 2.5 percent higher in August. Average salinities by water year type would decrease by five percent or more (up to 5.7 percent) during May and June of critical years. In addition, average salinities by water year type would increase by five percent or more (up to 10.7 percent) during August and September of above normal and below normal years, and July of dry years (Appendix F5, 2 vs. 1, pg. 14).

Over the entire 16-year simulation period, monthly average salinities under the CEQA No Project Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 14.3 percent) during 4 of the 192 months modeled, and higher by ten percent or more (up to 16.5 percent) during 3 of the 192 months modeled. As a result of the increases in monthly average salinities under the CEQA No Project Alternative, modeled EC values between April and August would not with D-1641 standards during 3 additional months (1 above normal, 1 below normal, and 1 dry year in July), relative to the CEQA Existing Condition. In addition, during the 23 months in which neither alterative is compliant with D-1641 salinity standards, EC conditions would measurably improve (by up to 7.7 percent) under the No Project Alternative during 6 months, and measurably decline (by up to 16.5 percent) during 9 months (Appendix F5, 2 vs. 1, pg. 15 through 26).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA No Project Alternative, compared to the CEQA Existing Condition, would occur in all but critical water year types (**Table 9-133**).

Table 9-133. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, by Water Year Type, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	619	5	Jan (1)
Above Normal	483 - 2,389	9 - 17	Jul (1), Aug (1), Sep (1)
Below Normal	1,832 - 2,784	8 - 14	Aug (1), Sep (1)
Dry	1,431- 2,240	5 - 10	Jul (3), Aug (2)
Critical	---	---	---

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-134**).

Table 9-134. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,755	1,754	1,536	785	1,736	1,792	1,586	789	-19 (-1%)	38 (2%)	49 (3%)	4 (0%)
1987	1,796	1,611	931	276	2,022	1,785	953	275	225 (13%)	174 (11%)	22 (2%)	0 (0%)
1990	2,475	1,919	843	552	2,508	1,817	792	542	33 (1%)	-102 (-5%)	-52 (-6%)	-10 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be

impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-14: Salinity changes in the San Joaquin River at Airport Way Bridge (Vernalis) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Airport Way Bridge (Vernalis) are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the CEQA No Project Alternative would be equivalent to EC values under the CEQA Existing Condition. Similarly, monthly average salinities also would be identical under each alternative, and consequently would meet D-1641 compliance standards. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.7.1-15: Salinity changes in the San Joaquin River at Brandt Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Brandt Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the CEQA No Project Alternative would have only negligible changes in EC values (i.e., up to 0.1 percent), relative to the CEQA Existing Condition. Monthly average salinities also would be similar under each alternative, with only 14 of the 192 months modeled indicating any difference and a maximum relative change of 0.4 percent (Appendix F5, 2 vs. 1, pg. 27). Consequently, monthly average salinities would meet D-1641 compliance standards. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.7.1-16: Salinity changes in Middle River near Old River that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Middle River near Old River are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities under the CEQA No Project Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA Existing Condition during all months of the year. In addition, changes in average salinities by water year type under the CEQA No Project Alternative would not exceed 1.8 percent. Monthly average salinities also would be similar under each alternative, with a maximum relative change of 3.6 percent (Appendix F5, 2 vs. 1, pg. 41 through 52). Consequently, monthly average salinities would meet D-1641 compliance standards. Therefore CEQA No Project Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.7.1-17: Salinity changes in Old River at Tracy Road Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Old River at Tracy Road Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities under the CEQA No Project Alternative would be essentially equivalent (i.e., less than 1.0 percent change) to the CEQA Existing Condition during all months of the year. In addition, changes in average salinities by water year type under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would not exceed 1.9 percent. Monthly average salinities also would be similar under each alternative, with a maximum relative change of 3.0 percent (Appendix F5, 2 vs. 1, pg. 53). Consequently, monthly average salinities would meet D-1641 compliance standards. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.7.1-18: Salinity changes in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641. However this location is evaluated to address potential concerns related to the CCWD's water supply intake and potential impacts to water supplies associated with Los Vaqueros Reservoir.

Long-term average salinities at Highway 4 under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 2.1 percent lower in June to 2.2 percent higher in September. Average salinities by water year type would not decrease by five percent or more. However, average salinities by water year type would increase by five percent or more (up to 10.6 percent) during August and September of above and below normal years, August of dry years, and October of below normal years (Appendix F5, 2 vs. 1, pg. 79) .

Over the entire 16-year simulation period, monthly average salinities under the CEQA No Project Alternative would be lower than the CEQA Existing Condition by ten percent or more (11.2 percent) during 1 of the 192 months modeled, and higher by ten percent or more (up to 16.4 percent) during 2 of the 192 months modeled (Appendix F5, 2 vs. 1, pg. 81 through 91). Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA No Project Alternative, compared to the CEQA Existing Condition, would occur during all but wet and critical years (**Table 9-135**).

Table 9-135. Differences in Monthly Mean Salinity (µS/cm) in the Old River at Highway 4 (Los Vaqueros Intake), by Water Year Type, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

	Salinity Change (µS/cm)		
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	358 - 825	7 - 16	Oct (1), Aug (1), Sep (1)
Below Normal	476 - 773	5 - 11	Oct (1), Aug (1), Sep (1)
Dry	403 - 653	5 - 10	Jul (1), Aug (3)
Critical	---	---	---

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than five percent.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-136**).

Table 9-136. Differences in Monthly Mean Salinity (µS/cm) in Old River at Highway 4 (CCWD Los Vaqueros Intake), for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
Year	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	575	654	717	477	572	656	739	484	-3 (-1%)	2 (0%)	22 (3%)	7 (1%)
1987	646	573	629	375	673	650	662	380	27 (4%)	76 (13%)	33 (5%)	5 (1%)
1990	679	889	629	389	688	878	586	376	9 (1%)	-11 (-1%)	-42 (-7%)	-13 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-19: Salinity changes at CCWD Pumping Plant #1 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Sources of chlorides in Rock Slough include seawater, which intrudes into the Delta when freshwater outflow from the Delta is low, local drainage and seepage from adjacent lands, and the Sacramento and San Joaquin rivers. Seawater and local drainage are the primary concerns (DWR 2003b). There are no applicable EC objectives for CCWD Pumping Plant #1 noted in D-1641. However this location is evaluated to address potential concerns related to the CCWD's water supply intake.

Long-term average salinities at CCWD Pumping Plant #1 under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 2.4 percent lower in June to 2.4 percent higher in September. Average salinities by water year type would not decrease by five percent or more. However, average salinities by water year type would increase by five percent or more (up to 11.0 percent) during August and September of above and below normal years, August of dry years, and October of below normal years (Appendix F5, 2 vs. 1, pg. 92).

Over the entire 16-year simulation period, monthly average salinities under the CEQA No Project Alternative would be lower than the CEQA Existing Condition by ten percent or more (11.9 percent) during 1 of the 192 months modeled, and higher by ten percent or more (up to 18.2 percent) during 2 of the 192 months modeled (Appendix F5, 2 vs. 1, pg. 93 through 104).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA No Project Alternative, compared to the CEQA Existing Condition, would occur during all but wet and critical years (**Table 9-137**).

Table 9-137. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, by Water Year Type, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Salinity Change (µS/cm)			
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	---	---	---
Above Normal	396 - 987	8 - 18	Oct (1), Aug (1), Sep (1)
Below Normal	541 - 872	7 - 11	Oct (1), Aug (1), Sep (1)
Dry	450 - 756	5 - 10	Jul (1), Aug (3)
Critical	---	---	---

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-138**).

Table 9-138. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
	CEQA Existing Condition				**CEQA No Project Alternative**				**Absolute Difference (Relative Difference)[a]**			
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	641	743	825	535	637	744	852	542	-4 (-1%)	1 (0%)	27 (3%)	8 (1%)
1987	741	665	732	374	760	756	771	378	19 (3%)	91 (14%)	39 (5%)	4 (1%)
1990	733	1,036	707	402	742	1,028	657	391	9 (1%)	-8 (-1%)	-50 (-7%)	-11 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-20: Salinity changes in the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The applicable EC objective for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 1,000 µS/cm year-round.

Long-term average salinities at Clifton Court Forebay under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 1.8 percent lower in February to 2.2 percent higher in September. Average salinities by water year type would not decrease by five percent or more. In addition, average salinities by water year type would increase by five percent or more (up to 9.5 percent) during August, September and October of below normal, August of dry years, and September of above normal years (Appendix F5, 2 vs. 1, pg. 105).

Over the entire 16-year simulation period, monthly average salinities under the CEQA No Project Alternative would be lower than the CEQA Existing Condition by ten percent or more (10.5 percent) during 1 of the 192 months modeled, and higher by ten percent or more (14.7 percent) during 1 of the 192 months modeled (Appendix F5, 2 vs. 1, pg. 106 through 117). Modeled monthly average EC values under both alternatives between October and September would consistently comply with D-1641 standards.

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA No Project Alternative, compared to the CEQA Existing Condition, would occur during all but wet and critical years (**Table 9-139**).

Table 9-139. Differences in Monthly Mean Salinity (µS/cm) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant), by Water Year Type, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	319 - 740	5 - 15	Oct (1), Aug (1), Sep (1)
Below Normal	413 - 649	5 - 10	Aug (1), Sep (1)
Dry	545 - 566	6 - 9	Aug (3)
Critical	---	---	---

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-140**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Table 9-140. Differences in Monthly Mean Salinity (µS/cm) in the West Canal at the Mouth of Clifton Court Forebay (SWP Intake), for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	524	601	680	563	522	601	694	569	-2 (0%)	0 (0%)	14 (2%)	5 (1%)
1987	597	565	651	558	611	611	672	562	14 (2%)	46 (8%)	21 (3%)	4 (1%)
1990	601	788	650	563	606	784	615	551	5 (1%)	-4 (-1%)	-35 (-5%)	-12 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.7.1-21: Salinity changes in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The applicable EC objective for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 1,000 µS/cm year-round.

Long-term average salinities at Jones Pumping Plant under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 1.4 percent lower in June to 1.6 percent higher in September. Average salinities by water year type indicate no decreases of five percent or more. In addition, average salinities by water year type would increase by five percent or more (up to 8.0 percent) during August of below normal years and September of above normal and below normal years.

Over the entire 16-year simulation period, monthly average salinities under the CEQA No Project Alternative are not lower than the CEQA Existing Condition by ten percent or more during any month modeled, and higher by ten percent or more (10.8 percent) during 1 of the 192 months modeled. Modeled monthly average EC values under both alternatives between October and September would consistently be in compliance with D-1641 standards (Appendix F5, 2 vs. 1, pg. 118).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA No Project Alternative, compared to the CEQA Existing Condition, generally would occur during all bit critical years (**Table 9-141**).

Table 9-141. Differences in Monthly Mean Salinity (µS/cm) in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), by Water Year Type, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	328	5	Jul (1)
Above Normal	632 - 739	7 - 11	Oct (1), Sep (1)
Below Normal	450 - 697	6 - 10	Aug (1), Sep (1)
Dry	565 - 581	6 - 9	Aug (2)
Critical	---	---	---

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-142**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative would have a less than significant impact on Delta water quality.

Table 9-142. Differences in Monthly Mean Salinity (µS/cm) in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
Year	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	533	609	689	597	531	610	701	602	-2 (0%)	0 (0%)	12 (2%)	5 (1%)
1987	597	578	662	582	609	618	681	586	12 (2%)	40 (7%)	19 (3%)	4 (1%)
1990	607	777	672	584	612	774	641	572	5 (1%)	-3 (0%)	-31 (-5%)	-12 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.7.1-22: Salinity changes at Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for Middle River at Victoria Canal noted in D-1641.

Long-term average salinities at Victoria Canal under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 1.3 percent lower in February to 1.5 percent higher in September. Average salinities by water year type indicate no decreases of five percent or more. In addition, average salinities by water year type would increase by five percent or more (up to 6.7 percent) during September of above normal and below normal years (Appendix F5, 2 vs. 1, pg. 131).

Over the entire 16-year simulation period, monthly average salinities under the CEQA No Project Alternative and CEQA Existing Condition do not differ by ten percent or more during any of the 192 months modeled (Appendix F5, 2 vs. 1, pg. 132 through 143).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA No Project Alternative, compared to the CEQA Existing Condition, would occur in August of dry years (one occasion) and in September of both above normal (one occasion) and below normal (one occasion) years.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-143**).

Table 9-143. Differences in Monthly Mean Salinity (µS/cm) in Victoria Canal, for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
Year	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	397	468	547	461	396	467	558	467	-1 (0%)	-1 (0%)	11 (2%)	6 (1%)
1987	490	446	534	464	494	482	560	471	4 (1%)	37 (8%)	26 (5%)	7 (2%)
1990	448	609	563	419	450	612	532	405	2 (0%)	2 (0%)	-31 (-6%)	-15 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-23: Salinity changes at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns related to the City of Stockton's water supply intake.

Long-term average salinities at the Stockton Intake under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 1.5 percent lower in June to 1.7 percent higher in September. Average salinities by water year type indicate no decreases of five percent or more. In addition, average salinities by water year type would increase by five percent or more (up to 8.7 percent) during August of below normal years and September of above normal and below normal years (Appendix F5, 2 vs. 1, pg. 144).

Over the entire 16-year simulation period, monthly average salinities under the CEQA No Project Alternative are not lower than the CEQA Existing Condition by ten percent or more during any month modeled, and higher by ten percent or more (11.6 percent) during 1 of the 192 months modeled (Appendix F5, 2 vs. 1, pg. 145 through 156).

Model output demonstrates that increases in salinity equal to or greater than five percent under the CEQA No Project Alternative, compared to the CEQA Existing Condition, would occur during August and September of all but wet and critical years (**Table 9-144**).

Table 9-144. Differences in Monthly Mean Salinity (µS/cm) at the Stockton Intake, by Water Year Type, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	240 - 368	5 - 12	Aug (1), Sep (1)
Below Normal	292 - 417	6 - 9	Aug (1), Sep (1)
Dry	375 - 378	6 - 8	Aug (3)
Critical	---	---	---

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-145**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Table 9-145. Differences in Monthly Mean Salinity (µS/cm) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Salinity (µS/cm)												
Year	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	360	421	490	354	358	423	503	358	-2 (-1%)	2 (0%)	13 (3%)	4 (1%)
1987	392	381	442	336	409	421	462	341	16 (4%)	40 (10%)	20 (5%)	5 (1%)
1990	438	553	461	312	444	543	433	303	6 (1%)	-10 (-2%)	-27 (-6%)	-9 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.7.1-24: Changes in chloride concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable chloride ion concentration objectives for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations at Highway 4 under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 2.0 percent lower in February to 3.1 percent higher in September. Differences in average chloride ion concentration by water year type would not exceed 8 percent except during August and September of above normal and below normal years when they would be approximately 12 percent to 14 percent higher under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F5, 2 vs. 1, pg. 157).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent would occur during 26 of the 192 months modeled. During these 26 months, chloride ion concentrations would be higher under the CEQA No Project Alternative on 13 occasions and lower on 13 occasions. Differences in monthly average chloride ion concentrations under the CEQA No Project Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 29.5 percent) during 5 of the 192 months modeled and higher by ten percent or more (up to 23.7 percent) during 6 of the 192 months modeled (Appendix F5, 2 vs. 1, pg. 158 through 169). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-146**.

Table 9-146. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake) from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA No Project Alternative	129.3	102.7	102.0	86.3	64.8	44.2	36.9	41.2	45.3	54.8	98.7	132.3
CEQA Existing Condition	127.3	102.3	102.3	87.7	66.1	44.5	37.0	42.6	47.3	55.9	95.8	128.3

Temporal patterns in chloride ion concentrations under the CEQA Yuba Accord Alternative in the Delta are similar in nature to those previously discussed for salinity. During January and February, this is primarily due to the assumptions in the monthly model that relate to reservoir refill operations in New Bullards Bar and San Luis reservoirs. The modeling assumptions are designed such that the amount of lower Yuba River water available for Delta export would be reduced during the New Bullards Bar Reservoir refill period. Similarly, because water would be available during the wetter winter months when the Delta is in excess conditions, the model also selected this time to repay storage debt in San Luis Reservoir, which would be achieved by increasing exports. However, if both of these operations occurred at the same time, there would be greater exports but less Delta inflow due to reduced lower Yuba River outflows. In combination, both of these modeled operations contributed to the increases in chloride ion concentrations exhibited in the January and February output.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-147**).

Table 9-147. Differences in Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake, for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	114	136	154	60	113	137	161	61	-1 (-1%)	1 (0%)	6 (4%)	1 (2%)
1987	134	113	129	44	142	135	139	45	8 (6%)	22 (19%)	10 (7%)	1 (2%)
1990	143	203	82	46	146	200	76	44	3 (2%)	-3 (-2%)	-6 (-8%)	-2 (-4%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-25: Changes in chloride concentrations in CCWD Pumping Plant #1 (Rock Slough) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for CCWD Pumping Plant #1 (Rock Slough) is 150 mg/l year-round.

Long-term average chloride ion concentrations at CCWD Pumping Plant #1 (Rock Slough) under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 5.1 percent lower in June to 3.2 percent higher in September. Differences in average chloride ion concentration by water year type under the CEQA No Project Alternative would not exceed 8 percent except during August and September of above normal and below normal years when they would be approximately 12 percent to approximately 15 percent higher (Appendix F5, 2 vs. 1, pg. 170).

Over the entire 16-year simulation period, monthly average chloride concentrations would exceed 150 mg/l under both the CEQA No Project Alternative and CEQA Existing Condition 39 of the 192 months modeled. During those 39 months when chloride ion concentrations would exceed 150 mg/l, concentrations would be higher under the CEQA No Project Alternative, relative to the CEQA No Project Alternative by 0.1 percent to 14.2 percent on 21 occasions, and lower by 0.1 percent to 3.7 percent on 17 occasions, and equivalent on 1 occasion (Appendix F5, 2 vs. 1, pg. 171 through 182). There would also be 4 additional occurrences during dry and critical years under the CEQA No Project Alternative when monthly average chloride ion concentrations would exceed 150 mg/l, relative to the CEQA Existing Condition. Monthly average chloride ion concentrations from October through September are presented in **Table 9-148**.

Table 9-148. Monthly Mean Chloride Ion Concentrations (mg/l) CCWD Pumping Plant #1 (Rock Slough) from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA No Project Alternative	157.2	124.9	118.9	108.1	85.5	64.2	58.2	42.9	42.4	67.6	123.3	158.0
CEQA Existing Condition	154.4	124.1	119.2	109.4	87.5	64.6	58.2	43.2	44.7	68.8	119.9	153.1

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-149**).

Table 9-149. Differences in Monthly Mean Chloride Ion Concentrations (mg/l) at CCWD Pumping Plant #1 (Rock Slough), for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	114	134	143	89	113	135	147	90	0 (0%)	1 (0%)	5 (3%)	1 (2%)
1987	161	135	124	56	167	155	132	57	5 (3%)	20 (15%)	8 (7%)	1 (1%)
1990	156	188	117	63	158	185	108	61	2 (1%)	-2 (-1%)	-9 (-8%)	-2 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-26: Changes in chloride concentrations in Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives for Old River at Rock Slough (CCWD Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations in Old River at Rock Slough under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 0.1 percent lower in April to 3.3 percent higher in September. Differences in average chloride ion concentration by water year type would not exceed approximately 8 percent except during August and September of above normal and below normal years when they would be approximately 14 percent to 15 percent higher under the CEQA No Project Alternative (Appendix F5, 2 vs. 1, pg. 183).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent would occur during 32 of the 192 months modeled. During these 32 months, chloride ion concentrations would be higher under the CEQA No Project Alternative on 15 occasions and lower on 17 occasions. Differences in monthly average chloride ion concentrations would be lower under the CEQA No Project Alternative by ten percent or more (up to 26.9 percent) during 5 of the 192 months modeled and higher by ten percent or more (up to 24.7 percent) during 8 of the 192 months modeled (Appendix F5, 2 vs. 1, pg. 184 through 195). Monthly average chloride ion concentrations from October through September are presented in **Table 9-150**.

Table 9-150. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Rock Slough (CCWD Intake) from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

	Monthly Average Chloride Ion Concentration (mg/l)											
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA No Project Alternative	146.4	112.6	114.4	90.5	61.6	35.7	28.8	32.0	33.1	63.9	122.4	160.9
CEQA Existing Condition	144.0	112.2	114.9	92.5	63.2	36.0	28.8	33.2	35.6	64.7	118.5	155.8

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-151**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Table 9-151. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Rock Slough (CCWD Intake), for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	136	157	169	56	135	158	177	57	-1 (-1%)	1 (1%)	8 (4%)	1 (2%)
1987	153	126	131	32	165	153	140	32	12 (8%)	26 (21%)	9 (7%)	0 (1%)
1990	178	231	80	38	182	224	73	37	4 (2%)	-6 (-3%)	-7 (-8%)	-1 (-4%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.7.1-27: Changes in chloride concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 0.1 percent lower in December to 3.0 percent higher in September. Differences in average chloride ion concentration by water year type under the CEQA No Project Alternative, relative to the CEQA Existing Condition would not exceed 8 percent except during August and September of above normal and below normal years when they would be approximately 8 percent to approximately 13 percent higher (Appendix F5, 2 vs. 1, pg. 196).

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 250 mg/l under either the CEQA No Project Alternative or the CEQA Existing Condition. However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 29 of the 192 months modeled. During these 28 months, chloride ion concentrations would be higher under the CEQA No Project Alternative on 18 occasions and lower on 10 occasions, relative to the CEQA Existing Condition. Differences in chloride ion concentrations equal to or greater than 10 percent would occur during 9 of the 192 months modeled, and would be higher on 6 occasions and lower on 3 occasions under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F5, 2 vs. 1, pg. 197 through 208). Monthly average chloride ion concentrations from October through September are presented in **Table 9-152**.

Table 9-152. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Rock Slough (CCWD Intake) from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA No Project Alternative	102.1	87.0	82.5	73.8	56.8	44.5	38.7	40.2	46.9	45.7	72.0	99.2
CEQA Existing Condition	100.6	86.6	82.6	74.5	57.9	44.9	38.7	41.1	47.1	46.6	70.3	96.2

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-153**).

Table 9-153. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	86	105	124	63	85	105	128	64	-1 (-1%)	0 (0%)	4 (3%)	1 (2%)
1987	107	94	113	58	110	107	121	59	3 (3%)	14 (15%)	8 (7%)	1 (2%)
1990	102	157	85	53	103	156	79	50	1 (1%)	0 (0%)	-6 (-7%)	-3 (-5%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-28: Changes in chloride concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 0.1 percent lower in December to 2.2 percent higher in August. Differences in average chloride ion concentration by water year type under the CEQA No Project Alternative, relative to the CEQA Existing Condition would not exceed approximately 4 percent except during August and September of above normal and below normal years when they would be approximately 7 percent to approximately 10 percent higher; during August of dry years when they would be about 7 percent higher; and during May and July of critical years when they would be about 6 percent lower (Appendix F5, 2 vs. 1, pg. 209).

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 250 mg/l under either the CEQA No Project Alternative or the CEQA Existing Condition. However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 17 of the 192 months modeled. During these 17 months, chloride ion concentrations would be higher under the CEQA No Project Alternative on 10 occasions and lower on 7 occasions, relative to the CEQA Existing Condition. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 6 of the 192 months modeled, and would be higher (up to 15.1 percent) on 4 occasions and lower (up to 24.3 percent) on 2 occasions under the CEQA No Project Alternative (Appendix F5, 2 vs. 1, pg. 210 through 221).

Monthly average chloride ion concentrations from October through September are presented in **Table 9-154.**

Table 9-154. Monthly Mean Chloride Ion Concentrations (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA No Project Alternative	102.6	86.9	87.4	78.9	66.6	60.0	45.6	42.6	53.1	54.2	83.8	112.9
CEQA Existing Condition	101.2	86.5	87.5	79.4	67.4	60.1	45.6	43.7	54.4	54.9	82.0	110.6

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-155**).

Table 9-155. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	93	111	131	78	92	111	134	78	0 (0%)	0 (0%)	3 (2%)	1 (1%)
1987	108	104	124	75	111	113	129	76	3 (3%)	10 (9%)	5 (4%)	1 (1%)
1990	111	152	89	76	112	152	84	74	1 (1%)	-1 (-1%)	-5 (-5%)	-2 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-29: Changes in chloride concentrations in Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives in Middle River at Victoria Canal noted in D-1641. However, Middle River at Victoria Canal is an indicator of central Delta water quality and water quality at the Victoria Island agricultural siphons, and is therefore evaluated.

Long-term average chloride ion concentrations in Middle River at Victoria Canal under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 0.1 percent lower in December to 2.3 percent higher in September. Differences in average chloride ion concentration by water year type under the CEQA No Project Alternative, relative to the CEQA Existing Condition would not exceed approximately 5 percent except during August and September of above normal and below normal years when they would be approximately 6 percent to 10 percent higher, as well as during August of dry years when they would be about 8 percent higher, and during May and July of critical years during which they would be 6 percent lower (Appendix F5, 2 vs. 1, pg. 222).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 19 of the 192 months modeled. During these 19 months, chloride ion concentrations would be higher under the CEQA No Project Alternative on 12 occasions and lower on 5 occasions, relative to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA No Project Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 25.3 percent) during 2 of the 192 months modeled and higher by ten percent or more (up to 14.9 percent) during 3 of the 192 months modeled (Appendix F5, 2 vs. 1, pg. 223 through 234). Monthly average chloride ion concentrations from October through September are presented in **Table 9-156**.

Table 9-156. Monthly Mean Chloride Ion Concentrations (mg/l) in Middle River at Victoria Canal from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CEQA No Project Alternative	76.8	70.3	63.2	61.9	54.1	45.8	41.6	47.5	53.8	38.9	51.0	68.6
CEQA Existing Condition	76.0	70.0	63.3	62.3	55.0	46.0	41.6	48.7	54.8	39.5	49.9	67.1

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-157**).

Table 9-157. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Middle River at Victoria Canal, for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	59	76	95	57	59	76	98	58	0 (0%)	0 (0%)	3 (3%)	1 (2%)
1987	82	71	92	58	82	80	99	59	1 (1%)	9 (13%)	6 (7%)	1 (2%)
1990	71	111	72	51	72	111	68	49	0 (1%)	1 (0%)	-5 (-6%)	-2 (-4%)
[a] Values in parentheses represent the relative difference in monthly mean salinity.												

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-30: Changes in chloride concentrations at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives in Middle River at Victoria Canal noted in D-1641. However, this location is evaluated to address potential water quality concerns associated with the City of Stockton's water supply intake.

Long-term average chloride ion concentrations at the Stockton Intake under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would range from 0.3 percent lower in December to 3.2 percent higher in August. Differences in average chloride ion concentration by water year type under the CEQA No Project Alternative, relative to the CEQA Existing Condition would not exceed approximately 6 percent except during August and September of above normal and below normal years when they would be approximately 13 percent to 14 percent higher, as well as during August of dry years when they would be about 8 percent higher (Appendix F5, 2 vs. 1, pg. 235).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 30 of the 192 months modeled. During these 30 months, chloride ion concentrations would be higher under the CEQA No Project Alternative on 17 occasions and lower on 13 occasions, relative to the CEQA Existing Condition. Differences in monthly average chloride ion concentrations under the CEQA No Project Alternative would be lower than the CEQA Existing Condition by ten percent or more (up to 24.7 percent) during 4 of the 192 months modeled and higher by ten percent or more (up to 22.0 percent) during 8 of the 192 months modeled (Appendix F5, 2 vs. 1, pg. 236 through 247). Monthly average chloride ion concentrations from October through September are presented in **Table 9-158**.

Table 9-158. Monthly Mean Chloride Ion Concentrations (mg/l) at the Stockton Intake from October Through September Over the 16-year Simulation Period Under the CEQA No Project Alternative and the CEQA Existing Condition

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
CEQA No Project Alternative	58.1	50.5	45.9	44.9	38.8	32.1	36.3	44.0	31.7	26.3	39.1	51.7
CEQA Existing Condition	57.4	50.4	46.0	45.6	39.5	32.1	36.3	45.2	32.7	26.5	37.9	50.2

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the CEQA Existing Condition in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-159**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the CEQA No Project Alternative would have a less than significant impact on Delta water quality.

Table 9-159. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the CEQA No Project Alternative, Compared to the CEQA Existing Condition

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	CEQA Existing Condition				CEQA No Project Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	50	65	82	41	49	65	85	42	0 (-1%)	0 (1%)	3 (4%)	1 (2%)
1987	58	55	70	38	62	65	75	39	4 (7%)	10 (18%)	5 (7%)	1 (2%)
1990	69	97	57	35	70	95	53	33	1 (2%)	-2 (-2%)	-4 (-7%)	-1 (-4%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.7.1-31: Changes in DOC concentrations at Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no DOC objectives noted in D-1641 for any location within the Delta. However, consideration of data regarding the average DOC concentrations in the Delta, assumed levels of natural variation, and assumed relationships between DOC concentrations and THM formation in drinking water has resulted in establishment of a monthly change significance criterion for DOC of 0.4 mg/l (see Section 9.2.2.1).

Long-term average DOC concentrations and average DOC concentrations by water year type at Highway 4 under the CEQA No Project Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types. Monthly average DOC concentrations also would be similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 2 vs. 1, pg. 248). Consequently, changes in the monthly average DOC concentrations would not exceed significance criteria, and therefore, implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.7.1-32: Changes in DOC concentrations at Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations in the Old River at Rock Slough under the No Project Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types, while average DOC concentrations by water year type never would not differ by more than 0.1 mg/l. Monthly average DOC concentrations also would be similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 2 vs. 1, pg. 261). Consequently, changes in the monthly average DOC concentrations would not exceed significance criteria, and therefore, implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.7.1-33: Changes in DOC concentrations at West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations at Clifton Court Forebay under the No Project Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types, while average DOC concentrations by water year type would not differ by more than 0.1 mg/l. Monthly average DOC concentrations would also be similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 2 vs. 1, pg. 274). Consequently, changes in the monthly average DOC concentrations would not exceed monthly significance criteria, and therefore, implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.7.1-34: Changes in DOC concentrations at the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average DOC concentrations at Jones Pumping Plant under the CEQA No Project Alternative would be essentially equivalent (i.e., less than 0.1 mg/l change) to the CEQA Existing Condition during all months and water year types, while average DOC concentrations by water year type would not differ by more than 0.1 mg/l. Monthly average DOC concentrations also would be similar under each alternative, with a maximum absolute change of 0.2 mg/l (Appendix F5, 2 vs. 1, pg. 287). Consequently, changes in the monthly average DOC concentrations would not exceed monthly significance criteria, and therefore, implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact on Delta water quality.

Impact 9.2.7.1-35: Changes in monthly mean flows in Old River at Bacon Island that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Old River at Bacon Island under the CEQA No Project Alternative, relative to the CEQA Existing Condition would not exceed approximately 2 percent except during June when they would be about 5 percent higher under the CEQA No Project Alternative over the 16-year simulation period (Appendix F5, 2 vs. 1, pg. 400). The direction of flow under both the CEQA No Project Alternative and the CEQA Existing Condition moves towards the Delta pumps during all months and water years except during February through May of wet years. The magnitude of flows moving towards Delta pumps during February through May would be reduced, and essentially equivalent during most months and water years under the CEQA No Project Alternative. In general, the magnitude of flows moving towards Delta pumps during all water years under the CEQA No Project Alternative would be between about 4 cfs and about 250 cfs less from June through November, relative to the CEQA Existing Condition.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 38 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 154 months (Appendix F5, 2 vs. 1, pg. 301 through 312).

Overall, potential changes in monthly mean flows under the CEQA No Project Alternative, compared to the CEQA No Project Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-36: Changes in monthly mean flows in the Middle River at Middle River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Middle River at Middle River under the CEQA No Project Alternative, relative to the CEQA Existing Condition would not exceed approximately 2 percent over the 16-year simulation period (Appendix F5, 2 vs. 1, pg. 313). The direction of flow under both the CEQA No Project Alternative and the CEQA Existing Condition moves towards the Delta pumps during all months and water years. The magnitude of flows moving towards Delta pumps during February through May would be reduced, and essentially equivalent during most months and water years under the CEQA No Project Alternative. In general, the magnitude of flows moving towards Delta pumps during all water years under the CEQA No Project Alternative would be between about 2 cfs and about 170 cfs less from June through November.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 42 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 150 months (Appendix F5, 2 vs. 1, pg. 314 through 325).

Overall, potential changes in monthly mean flows under the CEQA No Project Alternative, compared to the CEQA No Existing Condition would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-37: Changes in monthly mean flows in the Middle River at Mowry Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Middle River at Mowry Bridge under the CEQA No Project Alternative, relative to the CEQA Existing Condition would not exceed approximately 1 percent over the 16-year simulation period (Appendix F5, 2 vs. 1, pg. 326). The direction of flow under both the CEQA No Project Alternative and the CEQA Existing Condition moves away from the Delta pumps except during October and November of above normal years; October, November, and May of below normal years; and October, November, April, and May of dry and critical years. The magnitude of flows moving towards Delta pumps during February through May would be reduced, and essentially equivalent during all months and water years under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Therefore, the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Delta water quality.

Impact 9.2.7.1-38: Decreases in San Luis Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Historically, the CVP and SWP have cooperated to try to maintain San Luis Reservoir above 300 TAF in response to the low-point problem and thus, avoid adverse impacts to water quality. . Combined long-term average monthly CVP and SWP reservoir storage and average monthly storage by water year type under the CEQA No Project Alternative would be essentially equivalent in San Luis Reservoir, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 2, pg. 1339 and 1376). In addition, there would be no additional months under the CEQA No Project Alternative when combined CVP and SWP monthly mean reservoir storage drops below 300 TAF (Appendix F4, 2 vs. 1, pg. 1340 through 1351; and 1377 through 1388). Therefore, the

CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on water quality in San Luis Reservoir.

9.2.7.2 NEPA No Action Alternative Compared to the NEPA Affected Environment

In the Yuba Region, the primary differences between the NEPA No Action Alternative and the NEPA Affected Environment are the changes in lower Yuba River flows associated with the implementation of the RD-1644 Long-term instream flow requirements to replace the RD-1644 Interim instream flow requirements, implementation of the Wheatland Project, which will increase surface water diversions at Daguerre Point Dam, and groundwater substitution pumping associated with the SVWMP.

In the Yuba Region, primary differences between the CEQA No Project and the Existing Condition are implementation of RD-1644 Long-term instream flow requirements, and implementation of the Wheatland Project. Therefore, in the Yuba Region, assumptions regarding the volume of SVWMP groundwater substitution pumping that may occur in the future are the only difference between the NEPA No Action and the CEQA No Project alternatives. Although groundwater substitution transfers may take place under different programs (single-year transfers versus SVWMP), the total volume of groundwater substitution is similar. Reservoir, dam and hydropower facilities operations, river flows, and water temperature model outputs for the lower Yuba River are therefore similar for the NEPA No Action Alternative compared to the NEPA Affected Environment, and for the CEQA No Project Alternative compared to the CEQA Existing Condition. Quantitative analysis for the latter is presented in Section 9.2.7.1 above. Trends in evaluation parameters previously presented for the CEQA No Project Alternative relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1) are similar to the comparison of the NEPA No Action Alternative relative to the NEPA Affected Environment, and are not repeated here.

The NEPA No Action Alternative includes additional projects in the project study area that are not included in the CEQA No Project Alternative. These proposed projects would not affect water supply and management in the Yuba Region and, thus, are only discussed in the context of CVP and SWP operations upstream of the Delta, in the Delta, and in the Export Service Area.

Projects included in the NEPA No Action Alternative include conveyance projects (SDIP and CVP/SWP Intertie), water supply projects to meet increasing demand (FRWP, American River diversions in accordance with the Water Forum), water transfer and acquisition programs (long-term EWA Program or a program equivalent to the EWA), and projects related to CVP/SWP system operations (CVP/SWP Integration). The NEPA No Action Alternative also considers 2020 level of development in the Sacramento Valley and increased SWP Table A demands.

The proposed projects included under the NEPA No Action Alternative would result in changes to reservoir operations, river and channel flows, river and channel diversions and pumping and power generation facilities in the Project Study Area, but outside of the Yuba Region. In general, the types of change that may occur and that could affect surface water quality include:

- ❑ Decreased Delta inflow
- ❑ Reduced Delta outflow
- ❑ Increased pumping at the Jones Pumping Plant;
- ❑ Increased pumping at the Banks Pumping Plant (including wheeling of CVP water);

- Increased E/I ratios in the fall and winter
- Reduced X2 in the fall and winter

9.2.8 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE NEPA YUBA ACCORD ALTERNATIVE COMPARED TO THE NEPA NO ACTION ALTERNATIVE

Impact 9.2.8-1: Decreases in New Bullards Bar Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year simulation period, differences in long-term average end-of-month storage and end-of-month storage by water year type under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would not exceed 5 percent (24 TAF to 51 TAF) except during August, September, October, November, and December and most months during critical years (Appendix F4, 6 vs. 5, pg. 1). During most months and water years when reservoir storage volumes are typically lowest[54] due to reservoir storage releases occurring from July through September, average differences in monthly mean storage under the NEPA Yuba Accord Alternative would range from about 6 percent lower (627 vs. 669 TAF) in August to about 8 percent lower in October (552 vs. 603 TAF), November (550 vs. 559 TAF), and September (584 vs. 632 TAF), compared to the NEPA No Action Alternative. Under the NEPA Yuba Accord Alternative, storage would be essentially equivalent or higher at least 50 percent of the time over the monthly cumulative distributions for all months of the year. During periods exhibiting the lowest storage conditions occurring in October and November, which includes the lowest monthly storage conditions on record for New Bullards Bar Reservoir[55], storage would be about 10 percent lower at least 10 percent of the time under the NEPA Yuba Accord Alternative (Appendix F4, 6 vs. 5, pgs. 26 through 37).

Generally, a greater volume of water present in the reservoir equates to a greater amount of dilution regarding any constituent of concern that may be present in the water. However, the magnitude and frequency (i.e., up to 10 percent lower 10 percent of the time during October and November) of the changes in reservoir storage levels simulated under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would not be likely to cause metals and other constituents of concern that may be concentrated in the sediments at the bottom of the reservoir to be re-suspended and degrade long-term water quality. In addition, decreases in water quality in New Bullards Bar due to increases in water temperature are unlikely to occur due to its steep-sided conical shape, which creates sufficient water depths to maintain a large cold pool reservoir under all operational reservoir levels throughout the year.

As a result of the water transfers occurring from July through September under the NEPA Yuba Accord Alternative, large reductions in New Bullards Bar Reservoir storage would be expected to occur during the late summer and fall. However, the frequency and magnitude of these reductions in storage would not be sufficient to reduce the long-term water quality in New Bullards Bar Reservoir due to the morphology of the reservoir. Therefore, the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would result in less than significant impacts to water quality in New Bullards Bar Reservoir.

[54] Generally, ranging from August through November for New Bullards Bar Reservoir.

[55] The lowest 25 percent of the cumulative probability storage volume distribution.

Impact 9.2.8-2: Changes in monthly mean flows in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

During the seasonal high flow period[56], long-term average flows in the lower Yuba River at Smartville would range from approximately 0.3 percent higher (3,033 vs. 3,024 cfs) during June to approximately 10 percent lower (2,033 vs. 2,243 cfs) in December under the NEPA Yuba Accord Alternative, compared to those under the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pg. 100). During the seasonal low flow period[57], long-term average flows in the lower Yuba River at Smartville would range from approximately 25 percent higher in August (1,963 vs. 1,578 cfs) to approximately 3 percent lower in November (1,128 vs. 1,160 cfs) under the NEPA Yuba Accord Alternative. Maximum decreases in mean monthly flow under the NEPA Yuba Accord Alternative would range from about 29 percent (959 vs. 1,339 cfs) to 21 percent (1,858 vs. 2,346 cfs) and occur during January and May of dry years. During critical years, flows would be generally higher by about 0.1 percent (791 vs. 790 cfs) to about 22 percent (680 vs. 557 cfs), compared to those under the NEPA No Action Alternative. During typically low flow conditions[58] occurring from August through November, flows under the NEPA Yuba Accord Alternative would be on average about 15 percent to 40 percent higher about 40 percent to 60 percent of the time (Appendix F4, 6 vs. 5, pg. 125 through 136).

During the seasonal high flow period, long-term average flows in the lower Yuba River at Marysville would range from approximately 1.1 percent higher (2,119 vs. 2,096 cfs) during June to approximately 9 percent lower (2,214 vs. 2,424 cfs) in December under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pg. 272). During the seasonal low flow period, long-term average flows in the lower Yuba River would range from approximately 58 percent higher in August (1,105 vs. 700 cfs) to approximately 3 percent lower in November (1,095 vs. 1,128 cfs) under the NEPA Yuba Accord Alternative. Maximum decreases of flows under the NEPA Yuba Accord Alternative would range from about 26 percent (1,094 vs. 1,473 cfs) to 31 percent (1,055 vs. 1,515 cfs), and occur during January and May of dry years. During critical water years, flows under the NEPA Yuba Accord Alternative would be generally higher by about 0.1 percent (944 vs. 943 cfs) to about 44 percent (459 vs. 319 cfs). During low flow conditions occurring from August through November, flows under the NEPA Yuba Accord Alternative would be on average about 20 percent to 99 percent higher about 60 percent to about 100 percent of the time compared to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pg. 297 through 308).

Overall, lower Yuba River flows under the NEPA Yuba Accord Alternative would be higher than flows under the NEPA No Action Alternative. Increased lower Yuba River flows would allow dilution of water quality constituents, including pesticides and fertilizers from agricultural runoff, potentially having a beneficial effect on water quality. Changes in the frequency and magnitude of flows in the lower Yuba River would not result in any long-term impacts to designated beneficial uses, existing regulatory standards, or degradation of general water quality. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on water quality in the lower Yuba River.

[56] Generally, ranging from December through June in the lower Yuba River.

[57] Generally, ranging from August through November in the lower Yuba River.

[58] The lowest 25 percent of the cumulative probability flow distribution.

Impact 9.2.8-3: Changes in monthly mean water temperatures in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average water temperatures in the lower Yuba River at Smartville under the NEPA Yuba Accord Alternative, compared to those under the NEPA No Action Alternative, would be essentially equivalent (less than 0.3°F difference) during most months, but would increase (0.3° F) in December (Appendix F4, 6 vs. 5, pg. 174). Long-term average water temperatures at Marysville would be essentially equivalent[59] during most months, but would increase (0.4° F) in May and would decrease (up to 2.1°F) in August under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pg. 346). Long-term average monthly water temperatures and average monthly water temperatures by water year in the lower Yuba River under the NEPA Yuba Accord Alternative would not exceed 65.2°F.

Under the NEPA Yuba Accord Alternative, long-term average water temperatures at Daguerre Point Dam during the April through July rice field flooding and planting period would be essentially equivalent during most months, and would increase slightly (0.3°F) in May and decrease slightly (0.6°F) in July compared to those under the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pg. 223). However, water temperatures during these months would not exceed about 58°F under either alternative. For all water years, average monthly water temperatures at Daguerre Point Dam would be essentially equivalent during most months under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, and would remain below 61°F under both alternatives (Appendix F4, 6 vs. 5, pg. 248 through 259).

Overall, lower Yuba River water temperatures under the NEPA Yuba Accord Alternative would be similar to the NEPA No Action Alternative. Water temperature changes occurring in the lower Yuba River would not be of sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would have a less than significant impact on water quality in the lower Yuba River.

Impact 9.2.8-4: Decreases in Oroville Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average end-of-month Oroville Reservoir storage would be essentially equivalent (up to 7 TAF difference) under the NEPA Yuba Accord Alternative (2,155 TAF) and the NEPA No Action Alternative (2,162 TAF) (Appendix F4, 6 vs. 5 pg. 406). Differences in average end-of-month storage under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would not exceed 1 percent (up to 18 TAF difference) in any water year. During all months, the cumulative reservoir storage distributions would be essentially equivalent[60] or higher nearly 100 percent of the time, under the NEPA Yuba Accord Alternative (Appendix F4, 6 vs. 5 pg. 431 through 442). Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on water quality in Oroville Reservoir.

[59] Essentially equivalent refers to water temperature differences between alternatives less than 0.3 °F.

[60] Essentially equivalent refers to relative percent differences between the alternative and the basis of comparison that are less than or equal to 1 percent.

Impact 9.2.8-5: Changes in monthly mean flows in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly flows or average monthly flows by water year type in the Feather River below the Fish Barrier Dam under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pg. 505).

Long-term average monthly flows in the Feather River below the Thermalito Afterbay Outlet would be about 1 percent lower (3,177 vs. 3,212 cfs) in April and 3 percent lower (4,735 vs. 4,886 cfs) in June under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, and essentially equivalent (less than a 5 cfs difference) or up to about 2 percent higher (6,858 vs. 6,746 cfs) during all other months (Appendix F4, 6 vs. 5, pg. 603). Long-term average monthly flows in the Feather River at the mouth under the NEPA Yuba Accord Alternative would be up to approximately 5 percent (7,843 vs. 7,448 cfs) to approximately 3 percent higher (3,439 vs. 3,339 cfs) from July through October and essentially equivalent to approximately 2 percent lower (7,421 vs. 7,448 cfs) from November through June (Appendix F4, 6 vs. 5, pg. 775). Decreases in average monthly flow below the Thermalito Afterbay Outlet and at the mouth of the Feather River would range from about 12 percent higher (5,321 vs. 4,764 cfs) to approximately 16 percent lower (2,921 vs. 3,454 cfs) during all water years. In addition, during July, August, September, and October of critical water years, flows would be up to 9 percent higher (4,090 vs. 3,744 cfs) under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative.

During low flow conditions occurring from September through November, below the Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative would be essentially equivalent about 35 to 75 percent of the time, and higher about 20 percent of the time (Appendix F4, 6 vs. 5, pg. 628 through 639). During low flow conditions at the mouth of the Feather River occurring from September through November, flows under the NEPA Yuba Accord Alternative would be essentially equivalent about 20 percent to 45 percent of the time, and higher about 55 percent to 80 percent of the time (Appendix F4, 6 vs. 5, pg. 800 through 811).

Overall, lower Feather River flows under the NEPA Yuba Accord Alternative would not increase or decrease substantially compared to the NEPA No Action Alternative and, thus, would not be expected to degrade water quality or adversely affect beneficial uses. Therefore, the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would have a less than significant impact on water quality in the lower Feather River.

Impact 9.2.8-6: Changes in monthly mean water temperatures in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly water temperatures or average monthly water temperatures by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative below the Fish Barrier Dam (Appendix F4, 6 vs. 5, pg. 554).

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type in the lower Feather River below the Thermalito Afterbay Outlet (Appendix F4, 6 vs. 5, pg. 677) under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would be essentially equivalent with the exception of June and July of above normal water years when they would be 0.3°F higher and 0.3°F lower. Long-term monthly water temperatures and average monthly water temperatures by water year type at the mouth of the Feather River would range from 0.7°F higher in May of dry years to 1.3ºF lower in August of wet years under the NEPA Yuba Accord compared to the NEPA No Action Alternative. Water temperatures below the Thermalito Afterbay Outlet would be essentially equivalent during all months under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, 90 percent to 100 percent of the time over the cumulative water temperature distribution (Appendix F4, 6 vs. 5, pg. 707 through 713). At the mouth of the Feather River, water temperatures would be essentially equivalent about 95 percent to 100 percent of the time during all months of the cumulative water temperature distribution with the exception of May, July, and August (Appendix F4, 6 vs. 5, pg. 849 through 860). During May water temperatures would be essentially equivalent about 55 percent of the time and higher up to 0.8ºF about 40 percent of the time. During the highest 25 percent of the cumulative water temperature distribution (i.e., highest 25 percent of water temperatures), water temperatures in May would be on average 0.5ºF higher about 40 percent of the time and slightly lower or essentially equivalent for the remainder of the distribution. During July, water temperatures under the NEPA Yuba Accord Alternative would be essentially equivalent about 10 percent of the time and slightly lower 90 percent of the time over the cumulative water temperature distribution. During August, water temperatures under the NEPA Yuba Accord Alternative would be essentially equivalent about 5 percent of the time and slightly lower 95 percent of the time over the cumulative water temperature distribution, relative to the NEPA No Action Alternative.

Overall, lower Feather River water temperatures under the NEPA Yuba Accord Alternative would be similar to the NEPA No Action Alternative. Water temperature changes occurring in the lower Feather River would not be of sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on water temperatures in the lower Feather River.

Impact 9.2.8-7: Changes in monthly mean flows in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Sacramento River below the confluence of the Feather River under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would be essentially equivalent during September, and from November through June (less than 1.0 percent change). Long-term average flows under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would be 1.0 percent (10,115 vs. 10,015 cfs), 2.7 percent (15,116 vs. 14,722 cfs), and 3.3 percent (12,809 vs. 12,402 cfs) higher during October, July, and August, respectively (Appendix F4, 6 vs. 5, pg. 882). Long-term average monthly flows in the Sacramento River at Freeport under the NEPA Yuba Accord Alternative would be essentially equivalent during most months, with the exceptions of July and August. During July, long-term average flows at Freeport under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would be 2.2 percent higher (18,260 vs. 17,866 cfs). During August, long-term average flows at Freeport under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would be 2.9 percent higher (14,643 vs. 14,236 cfs) (Appendix F4, 6 vs. 5, pg. 1005). Decreases in average monthly flow below the Feather River confluence and at Freeport would not exceed about 530 cfs during all water year types which would occur during June of critical water years at both locations. In addition, during July, August, September, and October of all water years, flows would be higher up to about 4 percent (approximately 500 cfs) under the NEPA Yuba Accord Alternative. Therefore, the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would have a less than significant impact on water quality in the Sacramento River.

Impact 9.2.8-8: Changes in monthly mean water temperatures in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type in the Sacramento River below the Feather River confluence (Appendix F4, 6 vs. 5, pg. 956) under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would be essentially equivalent except during August of wet and below normal years and July of wet years when they would be up to 0.4°F lower. Long-term average monthly water temperatures and average monthly water temperatures by water year type at Freeport would be essentially equivalent under the NEPA Yuba Accord and the NEPA No Action Alternative.

Water temperatures below the Feather River confluence and at Freeport would be essentially equivalent approximately 90 to approximately 100 percent of the time over the cumulative water temperature distribution with the exception of August at the mouth of the Feather River when water temperatures would be essentially equivalent about 70 percent of the time, and slightly lower 30 percent of the time over the cumulative water temperature distribution (Appendix F4, 6 vs. 5, pg. 981 through 992). Therefore, the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would have a less than significant impact on water quality in the Sacramento River.

Impact 9.2.8-9: Changes to the monthly mean location of X2 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The location of the estuarine salinity gradient is regulated during the months of February through June by the location of X2 objective in the 1995 WQCP (D-1641). The X2 location must remain downstream of the Confluence of the Sacramento and San Joaquin rivers[61] (River Kilometer 81, located upstream from the Golden Gate Bridge) for the entire 5-month period. The X2 objective also specifies the number of days each month that that location of X2 must be downstream of Chipps Island (RK 74) or downstream of Roe Island[62] (RK 64). However, due to DSM2 modeling limitations these two locations are not evaluated (see Section 9.2.1.2).

The long-term average monthly mean X2 location from February through June under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative are presented in **Table 9-160**. The long-term average monthly mean X2 location would range from 0.1 km higher (farther upstream towards the Confluence of the Sacramento and San Joaquin rivers) during February through May to 0.2 km higher during June. The long-term average X2 location by water year type would range from 0.1 km lower in February of critical years to 0.4 km higher in February of dry years under NEPA Yuba Accord Alternative (Appendix F4, 6 vs. 5, pg. 1189). Under the NEPA Yuba Accord Alternative, there would be 4 additional occurrences in February when the monthly mean X2 location would be upstream of the Confluence (RK 81) (Appendix F4, 6 vs. 5, pg. 1190 through 1201).

[61] Also referred to as Collinsville.

[62] Also referred to as the Port Chicago EC monitoring station.

Table 9-160. Long-term Average Monthly Mean X2 Location (RK) from February Through June Under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative

Long-term Average[a] Monthly Mean X2 Location (RK)					
Alternative	**Feb**	**Mar**	**Apr**	**May**	**Jun**
NEPA Yuba Accord Alternative	72.2	67.0	66.4	68.1	70.6
NEPA No Action Alternative	72.1	66.9	66.3	68.0	70.4

[a] Over the 72-year simulation period

Delta outflow objectives established in SWRCB D-1641 extend throughout the year. For the February though June period under the NEPA Yuba Accord Alternative, Delta outflow objectives are met by compliance with the X2 objective. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Overall, simulated changes in the monthly mean X2 location under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would not be of sufficient magnitude or frequency to adversely impact water quality resources in the Delta. Therefore, the NEPA Yuba Accord Alternative would result in a less than significant impact on Delta water quality.

Impact 9.2.8-10: Changes to monthly mean Delta outflow that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

As described above, Delta outflow objectives established in SWRCB D-1641 extend throughout the year and are met by compliance with the X2 objective during the February though June period. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641.

Over the entire 72-year period of simulated October through September outflows, differences in long-term average Delta outflows and average monthly outflows by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would not exceed 4 percent. Long-term average monthly Delta outflow by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would increase 4 percent during wet water years (4,177 vs. 4,032 cfs), and would decrease by 4 percent during dry water years (8,532 vs. 8,905 cfs) (Appendix F4, 6 vs. 5, pg. 1140). Therefore, the NEPA Yuba Accord Alternative would result in a less than significant impact on Delta water quality.

Impact 9.2.8-11: Changes to monthly mean E/I ratios that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The Delta E/I ratio limits, established in SWRCB D-1641, specify that up to 35 percent of Delta inflows may be exported during the February through June period, and up to 65 percent of Delta inflows may be exported during the remaining months (i.e., July through January). These limits would be consistently met under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative. In addition, differences in average monthly E/I ratios between the NEPA Yuba Accord Alternative and the NEPA No Action Alternative would be essentially equivalent during most months, and differences that do occur would not exceed 3 percent (E/I = 1) with the exception of June (17 percent lower [E/I = 3]) and August (4 percent higher [E/I = 1]) of critical years. Therefore, the NEPA Yuba Accord Alternative would result in a less than significant impact on Delta water quality.

Impact 9.2.8-12: Salinity changes in the Sacramento River at Emmaton that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Emmaton during the April through August period range from 450 to 2,780 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Emmaton under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would range from 2.0 percent (30 µS/cm) lower in August to 3.2 percent (27 µS/cm) higher in June. Differences in long-term average salinities by water year type would occur during September of above normal years when they would be 5 percent (92 µS/cm) lower under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (Appendix F5, 6 vs. 5, pg. 1).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Yuba Accord Alternative would not be lower than the NEPA No Action Alternative by ten percent or more however, salinities would be higher by ten percent or more (up to 12.8 percent (100 µS/cm) during 1 of the 192 months modeled. In addition, during the 15 modeled months in which neither alternative would comply with D-1641 standards, EC conditions would measurably improve (by up to 4.6 percent (109 µS/cm)) under the NEPA Yuba Accord Alternative during 10 months, and decline (by 12.8 percent (51 µS/cm)) during 5 months (Appendix F5, 6 vs. 5, pg. 2 through 13). Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-161**).

Table 9-161. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, by Water Year Type, under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	1031	5	Jan (1)
Above Normal	---	---	---
Below Normal	---	---	---
Dry	322 – 1,104	6 - 9	Jan (2), May (2), Jun (1), Jul (2)
Critical	554 – 2,172	6 - 13	May (2), Jun (3), Jul (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.

[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-162**).

Table 9-162. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
Year	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,339	1,296	785	368	1,349	1,317	781	367	11 (1%)	21 (2%)	-4 (-1%)	-1 (0%)
1987	2,002	1,103	499	237	2,048	1,146	507	238	45 (2%)	43 (4%)	7 (1%)	1 (0%)
1990	1,562	822	526	536	1,562	763	504	578	0 (0%)	-59 (-7%)	-22 (-4%)	41 (8%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-13: Salinity changes in the San Joaquin River at Jersey Point that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Jersey Point during the April through August period range from 450 to 2,200 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Jersey Point under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would range from 0.6 percent (10 µS/cm) lower in November to 4.5 percent (48 µS/cm) higher in July. Average salinities by water year type would decrease by 5 percent (152 µS/cm) or more during September of above normal years. However, increase by five percent or more would not occur (Appendix F5, 6 vs. 5, pg. 14).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Yuba Accord Alternative would be lower than the No Action Alternative by ten percent or more (up to 10.3 percent (230 µS/cm)) during 2 of the 192 months modeled, and higher by ten percent or more (up to 14.2 percent (278 µS/cm)) during 3 of the 192 months modeled. Modeled EC values between April and August would be in compliance with D-1641 standards 1 additional time under the NEPA No Action Alternative, relative to the NEPA Yuba Accord Alternative In addition, during the 17 months in which neither alterative would comply with D-1641 salinity standards, EC conditions would measurably improve (by up to 0.5 percent (13 µS/cm)) under the NEPA Yuba Accord Alternative during 4 months, and measurably decline (by up to 9.9 percent (169 µS/cm)) during 13 months (Appendix F5, 6 vs. 5, pg. 15 through 26).

Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-163**).

Table 9-163. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, by Water Year Type, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	524	5	Jul (1)
Above Normal	---	---	---
Below Normal	---	---	---
Dry	460 – 2,378	5 - 9	Jan (2), Feb (1), Jun (1), Jul (2), Aug (2)
Critical	387 – 2,243	4- 14	May (2), Jul (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison..

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-164**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on salinities Delta water quality.

Table 9-164. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
	NEPA No Action Alternative				**NEPA Yuba Accord Alternative**				**Absolute Difference (Relative Difference)[a]**			
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	2,394	1,983	1,346	606	2,359	1,938	1,327	603	-34 (-1%)	-45 (-2%)	-19 (-1%)	-3 (0%)
1987	1,940	1,475	1,120	454	1,996	1,535	1,144	456	56 (3%)	60 (4%)	24 (2%)	2 (0%)
1990	1,848	1,753	1,088	641	1,841	1,656	1,019	643	-8 (0%)	-97 (-6%)	-69 (-6%)	2 (0%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.8-14: Salinity changes in the San Joaquin River at Airport Way Bridge (Vernalis) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Airport Way Bridge (Vernalis) are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the NEPA Yuba Accord Alternative would be essentially equivalent (0 µS/cm change), relative to the NEPA No Action Alternative (Appendix F5, 6 vs. 5, pg. 27). Similarly, monthly average salinities also would be identical under each alternative, and consequently would meet D-1641 compliance standards. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-15: Salinity changes in the San Joaquin River at Brandt Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Brandt Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities under the NEPA Yuba Accord Alternative would differ only slightly (i.e., up to 0.2 percent (1 µS/cm)), relative to the NEPA No Action Alternative (Appendix F5, 6 vs. 5, pg. 40). Long-term average salinities by water year decrease by approximately 0.7 percent (5 µS/cm) in August of dry years under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. Monthly average salinities also would remain similar under each alternative, with only 8 of the 192 months modeled indicating any difference (decrease up to 3.2 percent 19 µS/cm)) (Appendix F5, 6 vs. 5, pg. 41 through 52). In addition, monthly average salinities would meet D-1641 compliance standards under both alternatives. Therefore, implementation of the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-16: Salinity changes in Middle River near Old River that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Middle River near Old River are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities in Middle River near Old River under the NEPA Yuba Accord Alternative would range from 1.1 percent (6 µS/cm) and 2.1 percent (9 µS/cm) higher in July and August to less than one percent (less than 1 µS/cm to 5 µS/cm) difference in all remaining months, relative to the NEPA No Action Alternative. In addition, changes in average salinities by water year type under the NEPA Yuba Accord Alternative, would not exceed 5 percent (approximately 25 µS/cm) except during August of dry years when they would be 6.1 percent (30 µS/cm) higher (Appendix F5, 6 vs. 5, pg. 53). Monthly average salinities also would remain similar under each alternative, and would not differ by 10 percent (approximately 40 µS/cm) or more (Appendix F5, 6 vs. 5, pg. 54 through 65). However, increases in salinity equal to or greater than five percent (approximately 20 µS/cm) under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would occur (**Table 9-165**). However, monthly average salinities would meet D-1641 compliance standards.

Table 9-165. Differences in Monthly Mean Salinity (µS/cm) in the Middle River near Old River, by Water Year Type, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

	Salinity Change (µS/cm)		
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	475 - 542	5 - 7	Jul (1), Aug (3)
Critical	427	9	Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

Impact 9.2.8-17: Salinity changes in Old River at Tracy Road Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Old River at Tracy Road Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities in Old River at Tracy Road Bridge under the NEPA Yuba Accord Alternative would range from 2.4 percent (13 µS/cm) higher in August to less than one percent (approximately 6 µS/cm) difference from September through May, relative to the NEPA No Action Alternative. In addition, changes in average salinities by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would not exceed 5 percent (approximately 20 µS/cm). Monthly average salinities also would be similar under each alternative and higher by five percent or more (up to 5.4 percent (30 µS/cm)) during 3 out of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 66). However, monthly average salinities would meet D-1641 compliance standards. Therefore, implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on water quality in the Old River at Tracy Road Bridge.

Impact 9.2.8-18: Salinity changes in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

CCWD's Los Vaqueros Intake and pumping plant is located just upstream of the Highway 4 Bridge. Because the Los Vaqueros Intake is located directly on Old River and is several miles upstream from the mouth of Rock Slough, the EC measurements at the Los Vaqueros Intake are usually lower than corresponding EC measurements at CCWD's Pumping Plant #1 (Reclamation and DWR 2005). Los Vaqueros Reservoir is used to provide emergency storage and water quality "blending" water to reduce chloride concentrations in CCWD's delivered water. As described in Reclamation's OCAP (Reclamation 2004), CCWD only is able to fill Los Vaqueros Reservoir when water quality conditions in the Delta are good, which generally occurs from January through July. There are no applicable EC objectives for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641.

Differences in long-term average salinities at Highway 4 under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would range from less than one percent (0.1 µS/cm) to about 3 percent (13 µS/cm). Average salinities by water year type would not differ by five percent (20 µS/cm) or more except during August of dry years when they would be about 7 percent (47 µS/cm) higher under the NEPA Yuba Accord Alternative (Appendix F5, 6 vs. 5, pg. 79).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Yuba Accord Alternative would be higher than the NEPA No Action Alternative by ten percent or more (up to 15.3 percent (75 µS/cm)) during 2 of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 81 through 91).

Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-166**).

Table 9-166. Differences in Monthly Mean Salinity (µS/cm) in the Old River at Highway 4 (Los Vaqueros Intake), by Water Year Type, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	416 - 831	5 - 10	Feb (1), Jul (3), Aug (3)
Critical	565 - 761	7 - 15	Jul (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-167**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on salinities in Delta water quality.

Table 9-167. Differences in Monthly Mean Salinity (µS/cm) in Old River at Highway 4 (CCWD Los Vaqueros Intake), for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
Year	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	787	856	737	453	769	839	718	449	-19 (-2%)	-18 (-2%)	-20 (-3%)	-4 (-1%)
1987	695	594	605	402	700	616	620	406	6 (1%)	21 (4%)	15 (3%)	4 (1%)
1990	620	701	689	460	617	679	648	453	-3 (0%)	-22 (-3%)	-41 (-6%)	-7 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.8-19: Salinity changes at CCWD Pumping Plant #1 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Sources of chlorides in Rock Slough include seawater, which intrudes into the Delta when freshwater outflow from the Delta is low, local drainage and seepage from adjacent lands, and the Sacramento and San Joaquin rivers. However, seawater and local drainage are of primary concern (DWR 2003b). There are no applicable EC objectives for CCWD Pumping Plant #1 noted in D-1641. However this location is evaluated to address potential concerns related to the CCWD's water supply intake.

Differences in long-term average salinities at CCWD Pumping Plant #1 under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would range from less than one percent (0.2 µS/cm) to up to 3.5 percent (18 µS/cm) higher in August. In addition average salinities by water year type would increase by five percent or more (up to 7.2 percent (57 µS/cm)) during July and August of dry years under the NEPA Yuba Accord Alternative (Appendix F5, 6 vs. 5, pg. 92).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Yuba Accord Alternative would be higher than the NEPA No Action Alternative by ten percent or more (up to 16.9 percent (98 µS/cm)) during 2 of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 93 through 104).

Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-168**).

Table 9-168. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, by Water Year Type, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	469 - 948	6 - 11	Feb (1), Jul (3), Aug (2)
Critical	672 - 876	6- 17	Jul (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-169**).

Table 9-169. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	886	1,005	865	459	865	985	841	455	-22 (-2%)	-20 (-2%)	-24 (-3%)	-4 (-1%)
1987	793	659	693	434	796	685	711	437	3 (0%)	26 (4%)	18 (3%)	4 (1%)
1990	686	786	765	480	683	763	717	470	-3 (0%)	-23 (-3%)	-48 (-6%)	-10 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-20: Salinity changes in the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The SWP Banks Pumping Plant supplies water to the South Bay Aqueduct and the California Aqueduct. The applicable EC objective for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 1,000 µS/cm year-round.

Differences in long-term average salinities at Clifton Court Forebay under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would be less than or equal to one percent (0.1 µS/cm) from September through June, and up to 3.6 percent (15 µS/cm) higher in August. In addition average salinities by water year type would increase by five percent or more (up to 7.4 percent (44 µS/cm)) during June, July and August of dry and critical years under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (Appendix F5, 6 vs. 5, pg. 105).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Yuba Accord Alternative would be higher than the NEPA No Action Alternative by ten percent or more (up to 12.4 percent (59 µS/cm)) during 2 of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 106 through 117). Modeled monthly average EC values under both alternatives between October and September would consistently be in compliance with D-1641 standards.

Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-170**).

Table 9-170. Differences in Monthly Mean Salinity (µS/cm) in the West Canal at the Mouth of Clifton Court Forebay, by Water Year Type, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

	Salinity Change (µS/cm)		
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	366 - 688	5 - 10	July (3), Aug (3)
Critical	531- 629	5 - 12	Aug (1), Sep (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-171**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Table 9-171. Differences in Monthly Mean Salinity (µS/cm) in the West Canal at the Mouth of Clifton Court Forebay (SWP Intake), for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
Year	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	682	766	705	509	667	751	691	506	-15 (-2%)	-16 (-2%)	-14 (-2%)	-4 (-1%)
1987	620	588	597	505	623	600	609	510	3 (0%)	12 (2%)	12 (2%)	5 (1%)
1990	583	620	662	544	581	604	626	550	-2 (0%)	-17 (-3%)	-36 (-5%)	6 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.8-21: Salinity changes in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The Delta-Mendota Canal at the Jones Pumping Plant supplies drinking water to Jones and other communities. The applicable EC objective for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 1,000 µS/cm year-round.

Differences in long-term average salinities at Jones Pumping Plant under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would range from less than or equal to one percent (0.6 µS/cm) up to 1.8 percent (9 µS/cm) higher in June, July, and August. Average salinities by water year type would be 5 percent (31 µS/cm) higher in August of dry years under the NEPA Yuba Accord Alternative (Appendix F5, 6 vs. 5, pg. 118).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Yuba Accord Alternative would not differ by ten percent or more. Modeled monthly average EC values under both alternatives between October and September would consistently be in compliance with D-1641 standards (Appendix F5, 6 vs. 5, pg. 119 through 130). Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-172**).

Table 9-172. Differences in Monthly Mean Salinity (µS/cm) in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), by Water Year Type, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	503 - 721	5 - 7	Jul (1), Aug (3)
Critical	50 - 5781	5 - 7	Jun (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-173**).

Table 9-173. Differences in Monthly Mean Salinity (µS/cm) in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	656	743	722	625	645	732	713	623	-11 (-2%)	-11 (-1%)	-9 (-1%)	-3 (0%)
1987	615	624	647	647	617	631	655	650	1 (0%)	6 (1%)	8 (1%)	3 (0%)
1990	600	642	704	630	598	630	675	629	-2 (0%)	-12 (-2%)	-29 (-4%)	0 (0%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-22: Salinity changes at Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Middle River at Victoria Canal is an indicator of central Delta water quality and the water quality of Victoria Island agricultural siphons. There are no applicable EC objectives for Middle River at Victoria Canal noted in D-1641.

Differences in long-term average salinities at Victoria Canal under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would range from less than one percent (0.3 µS/cm) up to 2.2 percent (8 µS/cm) higher in June, July, and August. Average salinities by water year type would increase by five percent or more (6.7 percent (29 µS/cm)) during August of dry years under the NEPA Yuba Accord Alternative (Appendix F5, 6 vs. 5, pg. 131).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Yuba Accord Alternative would be higher than the NEPA No Action Alternative by ten percent or more (up to 10.2 percent (38 µS/cm)) during 1 of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 132 through 143).

Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-174**).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-175**).

Table 9-174. Differences in Monthly Mean Salinity (µS/cm) in the Middle River at Victoria Canal, by Water Year Type, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	354 - 503	5 - 9	Jul (2), Aug (3)
Critical	404 - 429	6 – 10	Jun (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

Table 9-175. Differences in Monthly Mean Salinity (µS/cm) in Victoria Canal, for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	500	609	596	485	491	599	584	481	-9 (-2%)	-10 (-2%)	-12 (-2%)	-4 (-1%)
1987	509	482	515	446	510	491	525	451	1 (0%)	10 (2%)	10 (2%)	5 (1%)
1990	464	484	601	480	462	475	574	473	-2 (0%)	-9 (-2%)	-27 (-5%)	-6 (-1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-23: Salinity changes at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns related to the City of Stockton's water supply intake.

Differences in long-term average salinities at the Stockton Intake under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would not exceed 2.4 percent (7 µS/cm). Average salinities by water year type would increase by five percent or more (up to 5.9 percent (19 µS/cm)) during July and August of dry years under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (Appendix F5, 6 vs. 5, pg. 144).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Yuba Accord Alternative would be higher than the NEPA No Action Alternative by ten percent or more (up to 10.6 percent (32 µS/cm)) during 1 of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 145 through 156).

Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-176**).

Table 9-176. Differences in Monthly Mean Salinity (µS/cm) at the Stockton Intake, by Water Year Type, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	292 - 418	5 - 8	Jul (3)
Critical	334 - 453	6 - 10	Jul (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.

[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-177**).

Table 9-177. Differences in Monthly Mean Salinity (µS/cm) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
	NEPA No Action Alternative				**NEPA Yuba Accord Alternative**				**Absolute Difference (Relative Difference)[a]**			
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	484	540	512	363	473	528	501	360	-11 (-2%)	-11 (-2%)	-11 (-2%)	-2 (-1%)
1987	425	400	440	337	429	412	450	341	4 (1%)	12 (3%)	10 (2%)	4 (1%)
1990	394	465	508	362	393	451	482	359	-1 (0%)	-14 (-3%)	-26 (-5%)	-3 (-1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-24: Changes in chloride concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objective for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations at Highway 4 under the NEPA Yuba Accord Alternative, compared to those under the NEPA No Action Alternative, would range from 1.9 percent (3 mg/l) lower in October to 6.2 percent (4 mg/l) higher in July (Appendix F5, 6 vs. 5, pg. 157). Differences in average chloride ion concentration by water year type under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative would not exceed about 4 percent except during June, July, and August of dry years when they would range from 5.9 percent (2 mg/l) to 11.5 percent (10 mg/l) higher; and during July of critical years when they would be 4.3 percent (4 mg/l) higher.

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 24 of the 192 months modeled. During these 24 months, chloride ion concentrations would be higher under the NEPA Yuba Accord Alternative on 17 occasions and lower on 7 occasions, compared to the NEPA No Action Alternative. Differences in monthly average chloride ion concentrations under the NEPA Yuba Accord Alternative would be lower than the NEPA No Action Alternative by ten percent or more (up to 16.6 percent (25 mg/l)) on two occasions and higher by ten percent or more (up to 23.9 percent (22 mg/l)) during 7 of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 158 through 169). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-178.**

Temporal patterns in chloride ion concentrations under the NEPA Yuba Accord Alternative in the Delta are similar in nature to those previously discussed for salinity.

Table 9-178. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake) from October Through September Over the 16-year Simulation Period Under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
NEPA Yuba Accord Alternative	140.6	124.4	115.2	109.2	80.0	49.6	40.3	42.4	46.7	61.9	87.1	123.1
NEPA No Action Alternative	143.4	125.8	116.0	109.5	80.4	49.8	40.3	42.2	45.3	58.3	82.8	123.9

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-179**).

Table 9-179. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake, for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
	NEPA No Action Alternative				**NEPA Yuba Accord Alternative**				**Absolute Difference (Relative Difference)[a]**			
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	174	194	160	79	169	189	155	78	-5 (-3%)	-5 (-3%)	-6 (-3%)	-1 (-1%)
1987	148	119	122	48	150	125	127	49	2 (1%)	6 (5%)	4 (4%)	1 (1%)
1990	127	150	146	57	126	144	135	56	-1 (-1%)	-6 (-4%)	-12 (-8%)	-1 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-25: Changes in chloride concentrations in CCWD Pumping Plant #1 (Rock Slough) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for CCWD Pumping Plant #1 (Rock Slough) is 250 mg/l from October through September.

Long-term average chloride ion concentrations at CCWD Pumping Plant #1 (Rock Slough) under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would range from 2.1 percent (4 mg/l) lower in October to 5.1 percent (5 mg/l) higher in July and August (Appendix F5, 6 vs. 5, pg. 170). Differences in average chloride ion concentration by water year type under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative would not exceed about 5 percent except during July and August of dry years when they would be up to about 10 percent (10 mg/l and 16 mg/l) higher.

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 150 mg/l under either the NEPA No Action Alternative or NEPA No Action Alternative. Differences in chloride ion concentrations equal to or greater than 5 percent occur during 20 of the 192 months modeled. During these 20 months, chloride ion concentrations would be higher under the NEPA Yuba Accord Alternative on 17 occasions and lower on 3 occasions, compared to the NEPA No Action Alternative. Differences in monthly average chloride ion concentrations under the NEPA Yuba Accord Alternative would be lower than the NEPA No Action Alternative by ten percent or more (up to 18.1 percent (34 mg/l)) on one occasions and higher by ten percent or more (up to 24.4 percent (28 mg/l)) during 6 of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 171 through 182). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-180**.

Table 9-180. Monthly Mean Chloride Ion Concentrations (mg/l) CCWD Pumping Plant #1 (Rock Slough) from October Through September Over the 16-year Simulation Period Under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative

	Monthly Mean Chloride Ion Concentration (mg/l)											
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA Yuba Accord Alternative	166.0	148.0	133.1	127.6	98.4	66.7	58.5	45.2	49.0	74.5	107.4	141.8
NEPA No Action Alternative	169.5	149.5	134.0	127.6	98.6	66.9	58.5	45.0	47.8	70.9	102.2	142.6

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-181**).

Table 9-181. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at CCWD Pumping Plant #1 (Rock Slough), for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	166	182	152	81	163	179	149	80	-3 (-2%)	-3 (-2%)	-4 (-2%)	-1 (-1%)
1987	173	137	120	66	174	143	124	67	1 (1%)	6 (4%)	4 (3%)	1 (1%)
1990	145	156	129	74	145	150	120	73	-1 (-1%)	-6 (-4%)	-9 (-7%)	-2 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-26: Changes in chloride concentrations in Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives for Old River at Rock Slough (CCWD Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations in Old River at Rock Slough under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would range from 2.1 percent (3 mg/l) lower in October to 6.5 percent higher (4 mg/l) in July (Appendix F5, 6 vs. 5, pg. 183). Differences in average chloride ion concentration by water year type under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative would not exceed 5 percent except during September of below normal years when they would be about 7 percent (10 mg/l) lower, and during July and August of dry years when they would be up to about 12 percent (13 mg/l) higher.

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 26 of the 192 months modeled. During these 26 months, chloride ion concentrations would be higher under the NEPA Yuba Accord Alternative on 19 occasions and lower on 7 occasions, compared to the NEPA No Action Alternative. Differences in monthly average chloride ion concentrations under the NEPA Yuba Accord Alternative would be lower by ten percent or more on 3 occasions (up to 17.5 percent (31 mg/l)) during the 192 months modeled and higher by ten percent or more (up to 25.0 percent (26 mg/l)) during 7 of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 184 through 195). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-182**.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-183**).

Table 9-182. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Rock Slough (CCWD Intake) from October Through September Over the 16-year Simulation Period Under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA Yuba Accord Alternative	161.5	138.5	132.6	115.9	79.7	42.7	32.5	34.4	41.6	70.3	103.4	147.9
NEPA No Action Alternative	164.9	140.1	133.6	116.1	80.3	43.0	32.4	34.2	40.3	65.9	98.8	149.5

Table 9-183. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Rock Slough (CCWD Intake), for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	211	217	167	65	204	212	161	64	-7 (-3%)	-6 (-3%)	-6 (-4%)	-1 (-1%)
1987	170	129	128	42	172	136	133	42	3 (2%)	8 (6%)	5 (4%)	0 (1%)
1990	145	175	147	50	144	167	134	49	-1 (-1%)	-9 (-5%)	-13 (-9%)	-1 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-27: Changes in chloride concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) under the NEPA Yuba Accord Alternative, compared to those under the NEPA No Action Alternative, would range from 1.7 percent (2 mg/l) lower in October to 5.8 percent (4 mg/l) higher in August (Appendix F5, 6 vs. 5, pg. 195). Differences in average chloride ion concentration by water year type under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative would not exceed 5 percent except during July and August of dry years when they would be about 10 percent (11 mg/l) higher under the NEPA Yuba Accord Alternative.

Over the entire 16-year simulation period, monthly mean chloride concentrations would not exceed 250 mg/l under either the NEPA Yuba Accord Alternative or the NEPA No Action Alternative (Appendix F5, 6 vs. 5, pg. 196 through 208). However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 19 of the 192 months modeled. During these 19 months, chloride ion concentrations under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative would be higher under the NEPA Yuba Accord Alternative on 14 occasions and lower on 5 occasions, compared to the NEPA No

Action Alternative. Differences in chloride ion concentrations equal to or greater than ten percent occur during 8 of the 192 months modeled, and would be higher (up to 18.5 percent (15 mg/l)) on 7 occasions and would not be lower (by 15.1 percent (17 mg/l)) on one occasion. Monthly mean chloride ion concentrations from October through September are presented in **Table 9-184**.

Table 9-184. Monthly Mean Chloride Ion Concentrations (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant) from October Through September Over the 16-year Simulation Period Under the NEPA No Action Alternative and the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA No Action Alternative	106.3	101.2	90.8	89.0	69.8	49.7	40.8	42.3	47.2	51.8	68.0	91.5
NEPA No Action Alternative	108.1	102.3	91.5	89.3	70.0	50.0	40.8	42.3	46.5	49.3	64.3	92.1

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-185**).

Table 9-185. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant), for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	127	154	135	83	124	150	130	82	-4 (-3%)	-4 (-2%)	-4 (-3%)	-1 (-2%)
1987	116	101	104	54	117	104	107	55	1 (1%)	4 (4%)	3 (3%)	1 (1%)
1990	102	113	131	62	101	109	121	60	-1 (-1%)	-4 (-3%)	-9 (-7%)	-2 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-28: Changes in chloride concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would range from 1.4 percent (2 mg/l) lower in October to 2.5

percent (2 mg/l) higher in July and August (Appendix F5, 6 vs. 5, pg. 209). Differences in average chloride ion concentration by water year type under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative would not exceed approximately 3 percent except during July and August of dry years when they would be up to about 6 and 7 percent (5 mg/l and 8 mg/l) higher and June of critical years when they would be about 3 percent (3 mg/l) higher.

Over the entire 16-year simulation period, monthly mean chloride concentrations would not exceed 250 mg/l under either the NEPA Yuba Accord Alternative or the NEPA No Action Alternative (Appendix F5, 6 vs. 5, pg. 210 through 221). However, differences in chloride ion concentrations equal to or greater than 5 percent occurred during 11 of the 192 months modeled. During these 11 months, chloride ion concentrations would be higher under the NEPA Yuba Accord Alternative on 9 occasions and lower on 2 occasions. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 1 (lower by up to 13.0 percent (14 mg/l)) of the 192 months modeled under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative. Monthly mean chloride ion concentrations from October through September are presented in **Table 9-186**.

Table 9-186. Monthly Mean Chloride Ion Concentrations (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant)from October Through September Over the 16-year Simulation Period Under the NEPA Accord Alternative and the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
NEPA Yuba Accord Alternative	107.9	100.9	92.8	89.2	71.2	62.1	48.3	48.3	62.9	70.4	87.1	118.6
NEPA No Action Alternative	109.4	101.7	93.3	89.5	71.4	62.2	48.3	48.2	61.6	68.7	84.9	119.4

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-187**).

Table 9-187. Differences in Monthly Mean Chloride Ion Concentrations (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
	NEPA No Action Alternative				**NEPA Yuba Accord Alternative**				**Absolute Difference (Relative Difference)[a]**			
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	123	144	139	115	120	141	137	115	-3 (-2%)	-3 (-2%)	-2 (-2%)	-1 (-1%)
1987	113	115	120	85	113	117	122	85	0 (0%)	2 (1%)	2 (2%)	0 (0%)
1990	109	119	135	82	109	116	127	82	0 (0%)	-3 (-3%)	-7 (-5%)	0 (0%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be

impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-29: Changes in chloride concentrations in Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives in Middle River at Victoria Canal noted in D-1641. However, Middle River at Victoria Canal is an indicator of central Delta water quality and water quality at the Victoria Island agricultural siphons, and is therefore evaluated.

Long-term average chloride ion concentrations in Middle River at Victoria Canal under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative, would range from 1.2 percent (1 mg/l) lower in October to 4.0 percent (2 mg/l) higher in August (Appendix F5, 6 vs. 5, pg. 222). Differences in average chloride ion concentration by water year type under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative would not exceed 5 percent except during July and August of dry years when they would be up to 11 percent (8 mg/l) higher.

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 18 of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 223 through 234). During these 18 months, chloride ion concentrations would be higher under the NEPA Yuba Accord Alternative on 13 occasions and lower on 5 occasions. Differences in monthly average chloride ion concentrations under the NEPA Yuba Accord Alternative would be higher than the NEPA No Action Alternative by ten percent or more (up to 17.6 percent (9 mg/l)) during 5 of the 192 months modeled. Monthly mean chloride ion concentrations from October through September are presented in Table 9-188.

Table 9-188. Monthly Mean Chloride Ion Concentrations (mg/l) in Middle River at Victoria Canal from October Through September Over the 16-year Simulation Period Under the NEPA No Action Alternative and the NEPA No Action Alternative

	Monthly Mean Chloride Ion Concentration (mg/l)											
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA Yuba Accord Alternative	74.1	75.8	67.7	72.4	61.4	49.4	44.3	46.9	47.9	42.2	48.9	62.1
NEPA No Action Alternative	75.0	76.3	68.1	72.7	61.6	49.6	44.3	46.8	46.5	40.7	47.1	62.6

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-189**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Table 9-189. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Middle River at Victoria Canal, for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	84	111	107	80	82	108	105	79	-2 (-2%)	-2 (-2%)	-3 (-3%)	-1 (-1%)
1987	86	79	88	55	86	82	90	56	0 (0%)	2 (3%)	3 (3%)	1 (1%)
1990	75	80	109	60	75	78	102	59	0 (-1%)	-2 (-3%)	-7 (-6%)	-1 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.8-30: Changes in chloride concentrations at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives at the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns associated with the City of Stockton's water supply intake.

Long-term average chloride ion concentrations at the Stockton Intake under the NEPA Yuba Accord Alternative, compared to those under the NEPA No Action Alternative, would range from 1.2 percent (1 mg/l) lower in September to 5.5 percent (2 mg/l) higher in July (Appendix F5, 6 vs. 5, pg. 235). Differences in average chloride ion concentration by water year type would not exceed approximately 5 percent except during July, August, and September of dry years when they would be up to 11 percent (5 mg/l) higher.

Over the entire 16-year simulation period, differences in chloride ion concentrations under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative equal to or greater than 5 percent occurred during 23 of the 192 months modeled. During these 23 months, chloride ion concentrations would be higher on 17 occasions and lower on 6 occasions. Differences in monthly mean chloride ion concentrations would be higher than the NEPA No Action Alternative by ten percent or more (up to 21.8 percent (8 mg/l)) during 6 of the 192 months modeled (Appendix F5, 6 vs. 5, pg. 236 through 247). Monthly mean chloride ion concentrations from October through September are presented in **Table 9-190**.

Table 9-190. Monthly Mean Chloride Ion Concentrations (mg/l) at the Stockton Intake from October Through September Over the 16-year Simulation Period Under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA Yuba Accord Alternative	59.4	56.5	54.3	57.5	48.7	37.8	38.5	40.4	30.4	31.0	37.7	51.3
NEPA No Action Alternative	60.1	56.8	54.6	57.7	48.9	37.9	38.5	40.2	29.3	29.4	36.0	51.9

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-191**).

Table 9-191. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the NEPA Yuba Accord Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	NEPA No Action Alternative				NEPA Yuba Accord Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	80	94	87	50	77	91	84	50	-3 (-3%)	-3 (-3%)	-3 (-3%)	-1 (-1%)
1987	66	60	69	39	67	62	72	39	1 (1%)	3 (5%)	3 (4%)	1 (2%)
1990	58	76	86	42	58	72	80	42	0 (-1%)	-3 (-5%)	-6 (-7%)	0 (-1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-31: Changes in DOC concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no DOC objectives noted in D-1641 for any location within the Delta. However, consideration of data regarding the average DOC concentrations in the Delta, assumed levels of natural variation, and assumed relationships between DOC concentrations and THM formation in drinking water has resulted in establishment of a monthly change significance criterion for DOC of 0.4 mg/l (see Section 9.2.2.1).

Long-term average DOC concentrations at Highway 4 under the NEPA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the NEPA No Action Alternative during all months of the year (Appendix F5, 6 vs. 5, pg. 248). In addition, changes in average DOC concentrations by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.1 mg/l. Consequently, changes in the monthly average DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-32: Changes in DOC concentrations in Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations in the Old River at Rock Slough under the NEPA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the NEPA No Action Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations would be equivalent under each alternative (Appendix F5, 6 vs. 5, pg. 261). Consequently, changes in the monthly average DOC concentrations would not exceed the significance criteria, and therefore, implementation of the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-33: Changes in DOC concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations at Clifton Court Forebay under the NEPA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the NEPA No Action Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations would be equivalent under each alternative (Appendix F5, 6 vs. 5, pg. 274). Consequently, changes in the monthly average DOC concentrations would not exceed the monthly change significance criteria, and therefore, implementation of the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-34: Changes in DOC concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average DOC concentrations at Jones Pumping Plant under the NEPA Yuba Accord Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the NEPA No Action Alternative during all months of the year. In addition, there would be no changes in average DOC concentrations by water year type under the NEPA Yuba Accord Alternative. Monthly average DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.1 mg/l (Appendix F5, 6 vs. 5, pg. 287). Consequently, changes in the monthly average DOC concentrations would not exceed the significance criteria, and therefore, implementation of the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-35: Changes in monthly mean flows in the Old River at Bacon Island that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Old River at Bacon Island under the NEPA Yuba Accord Alternative (1,438 cfs), relative to the NEPA No Action Alternative (1,520 cfs), would not exceed approximately 5 percent (Appendix F5, 6 vs. 5, pg. 300). The direction of flow under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative moves towards the Delta pumps during all months and water years except during April of wet years. The magnitude to flows moving towards Delta pumps during February through May of all water years would be essentially equivalent or reduced during most months and water years under the NEPA Yuba Accord Alternative.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 68 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 128 months (Appendix F5, 6 vs. 5, pg. 301 through 312).

Overall, potential changes in monthly mean flows under the NEPA Yuba Accord Alternative, compared to those under the NEPA No Action Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-36: Changes in monthly mean flows in the Middle River at Middle River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows and average monthly flows by water year type in the Middle River at Middle River would not exceed about 4 percent under the NEPA Yuba Accord Alternative (3,429 cfs), relative to the NEPA No Action Alternative (3,323 cfs) (Appendix F5, 6 vs. 5, pg. 313). The direction of flow under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative moves towards the Delta pumps during all months and water years. Magnitude of flows moving towards Delta pumps under the NEPA Yuba Accord and NEPA No Action alternatives during December through June would be reduced, and would be essentially equivalent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative during most months and water years.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 61 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 131 months (Appendix F5, 6 vs. 5, pg. 314 through 365).

Overall, potential changes in monthly mean flows under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-37: Changes in monthly mean flows in the Middle River at Mowry Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Middle River at Mowry Bridge would be essentially equivalent (0 cfs to 1 cfs) during most months under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (Appendix F5, 6 vs. 5, pg. 326). The direction of flow under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative moves away from the Delta pumps and is also essentially equivalent during most months and water years with the exception of June of critically years.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 67 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 125 months (Appendix F5, 6 vs. 5, pg. 327 through 338).

Overall, potential changes in monthly mean flows under the NEPA Yuba Accord Alternative, compared to the NEPA No Action Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.8-38: Decreases in San Luis Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Historically, the CVP and SWP have cooperated to try to maintain San Luis Reservoir above 300 TAF in response to the low-point problem and thus, avoid adverse impacts to water quality. Combined CVP/SWP San Luis Reservoir long-term average monthly storage and monthly storage by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No

Action Alternative, would be essentially equivalent. Combined average CVP/SWP storage also would be essentially equivalent during most water years except during dry and critical years when storage would be up to 4 percent lower (153 vs. 159 TAF) under the NEPA Yuba Accord Alternative (Appendix F4, 6 vs. 5, pgs. 1339 and 1376). However, there would be no additional months under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, when the combined CVP/SWP monthly mean reservoir storage drops below 300 TAF (Appendix F4, 6 vs. 5. pg. 1340 through 1351; and 1377 through 1388). Therefore, the NEPA Yuba Accord Alternative would have a less than significant impact on water quality in San Luis Reservoir.

9.2.9 Environmental Impacts/Environmental Consequences of the NEPA Modified Flow Alternative Compared to the NEPA No Action Alternative

Impact 9.2.9-1: Decreases in New Bullards Bar Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year simulation period, differences in long-term average end-of-month storage and end-of-month storage by water year type under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would not exceed 10 percent (558 vs. 617 TAF) (Appendix F4, 7 vs. 5, pg. 50) except during September of critical years when storage under the CEQA Modified Flow Alternative would be up to 14 percent higher (483 vs. 422 TAF). During months when reservoir storage volumes are typically lowest[63], differences in end-of-month mean storage would range from 4 percent lower (644 vs. 669 TAF) in August to about 6 percent lower (569 vs. 603 TAF) in October and November under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pg. 51 through 62). Differences in mean end-of-month storage during all other months would not exceed 3 percent (584 vs. 604 TAF). During periods exhibiting the lowest reservoir storage conditions[64] occurring in October and November, which includes the lowest monthly storage conditions on record for New Bullards Bar Reservoir, storage would be on average about 10 percent higher about 70 percent of the time (Appendix F4, 7 vs. 5, pg. 75 through 86) under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative.

Generally, a greater volume of water present in the reservoir equates to a greater amount of dilution regarding any constituent of concern that may be present in the water. However, the magnitude and frequency (i.e., up to 4 percent lower during some months) of the changes in reservoir storage levels simulated under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would not be likely to cause metals and other constituents of concern that may be concentrated in the sediments at the bottom of the reservoir to be re-suspended and degrade long-term water quality. In addition, decreases in water quality in New Bullards Bar due to increases in water temperature are unlikely to occur due to its steep-sided conical shape, which creates sufficient water depths to maintain a large cold pool reservoir under all operational reservoir levels throughout the year.

Overall, the potential changes in reservoir in end-of-month reservoir storage under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would not be substantial enough to adversely affect water quality in New Bullards Bar Reservoir. Therefore,

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[63] Generally, ranging from August through November in the lower Yuba River.

[64] The lowest 25 percent of the cumulative probability storage distribution.

the NEPA Modified Flow Alternative would have a less than significant impact on water quality in New Bullards Bar Reservoir.

Impact 9.2.9-2: Changes in monthly mean flows in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

During the seasonal high flow period (i.e., December through June), long-term average flows in the lower Yuba River at Smartville would range from essentially equivalent (2,853 vs. 2,845 cfs) in March to approximately 7 percent lower (2,084 vs. 2,243 cfs) in December under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative over the 72-year simulation period (Appendix F4, 7 vs. 5, pg. 100). During the seasonal low flow period[65], long-term average flows in the lower Yuba River at Smartville would range from approximately 20 percent higher (1,884 vs. 1,578 cfs) in August to approximately 6 percent lower (1,091 vs. 1,160 cfs) in November under the NEPA Modified Flow Alternative. During typically low flow conditions[66] occurring from August through November, flows would be on average about 5 percent to 15 percent lower about 20 percent to 30 percent of the time in August and September; and 30 percent to 10 percent higher about 70 percent of the time in October and November (Appendix F4, 7 vs. 5, pg. 125 through 136) under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative.

During the seasonal high flow period, long-term average flows in the lower Yuba River at Marysville would range from essentially equivalent (3,263 vs. 3,256 cfs) in March, to approximately 7 percent lower (2,265 vs. 2,424 cfs) in December under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pg. 272). During the seasonal low flow period (i.e., August, September, October, and November), long-term average flows in the lower Yuba River at Marysville would range from approximately 40 percent higher (1,004 vs. 700 cfs) in August to approximately 6 percent lower (1,056 vs. 1,128 cfs) in November under the NEPA Modified Flow Alternative. During typically low flow conditions from August through November, flows under the NEPA Modified Flow Alternative would be on average about 30 percent to 15 percent lower about 100 percent to 40 percent of the time in August and September; and 3 percent to 4 percent higher 50 percent to 95 percent of the time in October and November under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pg. 297 through 308).

Overall, lower Yuba River flows under the NEPA Modified Flow Alternative would change substantially compared to those under the NEPA No Action Alternative. Slight changes in the frequency and magnitude of flows in the lower Yuba River under the NEPA Modified Flow Alternative would not result in any long-term impacts to designated beneficial uses, existing regulatory standards, degradation of general water quality. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on water quality in the lower Yuba River.

Impact 9.2.9-3: Changes in monthly mean water temperatures in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average water temperatures in the lower Yuba River at Smartville under the NEPA Modified Flow Alternative, compared to those under the NEPA No Action Alternative would be essentially equivalent (less than 0.3ºF difference) during all months. Long-term average

[65] Generally ranging from August through November in the lower Yuba River.

[66] The lowest 25 percent of the cumulative probability flow distribution.

water temperatures by water year type would range from 0.4ºF lower in August of wet years to 0.4ºF higher in January of below normal years and May of critical years (Appendix F4, 7 vs. 5, pg. 174). Long-term average water temperatures at Marysville under the NEPA Modified Flow Alternative would range from 1.5ºF lower in July to 0.8ºF higher in May and June. Long-term average water temperatures by water year type would range from 2.6ºF lower in July of above normal years to 3.1ºF higher in June of critical years. Additionally, long-term average monthly water temperatures and average monthly water temperatures by water year in the lower Yuba River would not exceed 67ºF under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative.

Under the NEPA Modified Flow Alternative, long-term average water temperatures at Daguerre Point Dam during the April through July period would range from 0.7ºF lower in July and August to 0.3ºF higher in May compared to those under the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pg. 223). However, water temperatures during these times would not exceed about 60ºF under either alternative. For all water years, average monthly water temperatures at Daguerre Point Dam under the NEPA Modified Flow Alternative would range from 1.0ºF lower in July and August of above normal years to 0.9ºF higher in May of critical years and generally would remain below 60ºF. There would be no occurrences under either the NEPA Modified Flow Alternative or the NEPA No Action Alternative during which monthly mean water temperatures would exceed 65ºF (Appendix F4, 7 vs. 5, pg. 248 through 259).

Overall, lower Yuba River water temperatures under the NEPA Modified Flow Alternative would be similar to the NEPA No Action Alternative. Water temperature changes occurring in the lower Yuba River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on water quality in the lower Yuba River.

Impact 9.2.9-4: Decreases in Oroville Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average end-of-month Oroville Reservoir storage and average monthly storage by water year type would be essentially equivalent[67] (up to 7 TAF difference) under the NEPA Modified Flow Alternative (2,929 TAF), and NEPA No Action Alternative (2,936 TAF) (Appendix F4, 7 vs. 5, pg. 406). During all months, the end-of-month cumulative reservoir storage distributions would be equivalent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative over 90 percent of the time (Appendix F4, 7 vs. 5, pg. 431 through 442). Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on water quality in Oroville Reservoir.

Impact 9.2.9-5: Changes in monthly mean flows in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly flows or average monthly flows by water year type in the Feather River below the Fish Barrier Dam under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pg. 505).

Long-term average monthly flows in the Feather River below the Thermalito Afterbay Outlet would range from 1.9 percent higher (3,669 vs. 3,600 cfs) in May to 1.6 percent lower (2,719 vs. 2,763 cfs) in October under the NEPA Modified Flow Alternative, relative to the NEPA No

[67] Essentially equivalent refers to relative percent differences in storage volume between the alternative and the basis of comparison that are less than 1 percent.

Action Alternative (Appendix F4, 7 vs. 5, pg. 603). Long-term average monthly flows in the Feather River at the mouth under the NEPA Modified Flow Alternative would be up to approximately 6 percent higher (5,853 vs. 5,545 cfs) in August to approximately 2 percent lower (5,893 vs. 6,024 cfs)in December (Appendix F4, 7 vs. 5, pg. 775). Decreases in average monthly flow below the Thermalito Afterbay Outlet and at the mouth of the Feather River would range from 1 percent lower (3,206 vs. 3,237 cfs) to approximately 16 percent lower (2,902 vs. 3,454 cfs) during all water years.

During low flow conditions occurring from September through November, below the Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative would be essentially equivalent about 70 to 95 percent of the time (Appendix F4, 7 vs. 5, pg. 628 through 639). During low flow conditions at the mouth of the Feather River occurring from September through November, flows under the NEPA Modified Flow Alternative would be essentially equivalent about 50 percent of the time, and higher about 50 percent of the time (Appendix F4, 7 vs. 5, pg. 800 through 811).

Overall, lower Feather River flows under the NEPA Modified Flow Alternative would not substantially change compared to those under the NEPA No Action Alternative and, thus, would not be expected to degrade water quality or adversely affect beneficial uses. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on water quality in the lower Feather River.

Impact 9.2.9-6: Changes in monthly mean water temperatures in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

There would be no differences in long-term average monthly water temperatures or average monthly water temperatures by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative below the Fish Barrier Dam (Appendix F4, 7 vs. 5, pg. 554).

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type in the lower Feather River below the Thermalito Afterbay Outlet (Appendix F4, 7 vs. 5, pg. 677) would be essentially equivalent (no change to 0.3ºF difference). Differences in water temperatures at the mouth (Appendix F4, 7 vs. 5, pg. 824) under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would be essentially equivalent during most months and water years. Differences that occur generally would not exceed 0.4ºF. Water temperatures below the Thermalito Afterbay Outlet would be essentially equivalent during all months under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, 95 percent to 100 percent of the time over the cumulative water temperature distribution (Appendix F4, 7 vs. 5, pg. 707 through 713). At the mouth of the Feather River, water temperatures would be essentially equivalent about 95 percent to 100 percent of the time during all months of the cumulative water temperature distribution with the exception of May through August (Appendix F4, 7 vs. 5, pg. 849 through 860). During May water temperatures would be essentially equivalent about 70 percent of the time and higher up to 1.2ºF about 30 percent of the time. During the highest 25 percent of the cumulative water temperature distribution (i.e., highest 25 percent of water temperatures), water temperatures in May would be on average 0.5ºF higher about 60 percent of the time and essentially equivalent for the remainder of the distribution. During June water temperatures would be essentially equivalent about 80 percent of the time and higher up to 0.6ºF about 20 percent of the time. During the highest 25 percent of the cumulative water temperature distribution (i.e., highest 25 percent of water temperatures), water temperatures in

June would be on average 0.4ºF higher about 40 percent of the time and essentially equivalent for the remainder of the distribution. During July, water temperatures would be essentially equivalent about 40 percent of the time and slightly lower 60 percent of the time over the cumulative water temperature distribution. During August, water temperatures under the NEPA Modified Flow Alternative, would be essentially equivalent about 5 percent of the time and slightly lower 95 percent of the time over the cumulative water temperature distribution, relative to the NEPA No Action Alternative.

Overall, lower Feather River water temperatures under the NEPA Modified Flow Alternative would be similar to the NEPA No Action Alternative. Water temperature changes occurring in the lower Feather River would not be sufficient frequency and magnitude to result in adverse impacts to designated beneficial uses (e.g., agriculture) or regulatory standards. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on water quality in the lower Feather River.

Impact 9.2.9-7: Changes in monthly mean flows in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Sacramento River below the confluence of the Feather River and at Freeport under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would be essentially equivalent during all months except July and August which would be up to 2.5 percent higher (12,710 vs. 12,402 cfs) (Appendix F4, 7 vs. 5, pgs. 882 and 1005). Decreases in average monthly flow below the Feather River confluence and at Freeport would not exceed 6 percent (10,208 vs. 10,759 cfs) during all water years. In addition, during July, August, September, and October of all water years except critical years, flows would be higher up to about 4 percent (13,055 vs. 12,498 cfs) or essentially equivalent (no change to 6 cfs higher) under the NEPA Modified Flow Alternative. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on water quality in the Sacramento River.

Impact 9.2.9-8: Changes in monthly mean water temperatures in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Over the 72-year period of simulation, long-term average monthly water temperatures and average monthly water temperatures by water year type in the Sacramento River below the Feather River confluence (Appendix F4, 7 vs. 5, pg. 956) and at Freeport (Appendix F4, 7 vs. 5, pg. 1054) under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would be essentially equivalent (0ºF to 0.3ºF difference) except during July and August of wet years below the Feather River confluence when they would be up to 0.4ºF lower below the Feather River confluence.

Water temperatures below the Feather River confluence and at Freeport would be essentially equivalent approximately 90 to 100 percent of the time over the cumulative water temperature distribution (Appendix F4, 7 vs. 5, pg. 981 through 992 and 1079 through 1090). Therefore, the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative, would have a less than significant impact on water quality in the Sacramento River.

Impact 9.2.9-9: Changes to the monthly mean location of X2 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The location of the estuarine salinity gradient is regulated during the months of February through June by the location of X2 objective in the 1995 WQCP (D-1641). The X2 location must remain downstream of the Confluence of the Sacramento and San Joaquin rivers[68] (River Kilometer 81, located upstream from the Golden Gate Bridge) for the entire 5-month period. The X2 objective also specifies the number of days each month that that location of X2 must be downstream of Chipps Island (RK 74) or downstream of Roe Island[69] (RK 64). However, due to DSM2 modeling limitations these two locations are not evaluated (see Section 9.2.1.2).

The long-term average monthly mean X2 location from February through June under the NEPA Modified Flow Alternative and the NEPA No Project Alternative are presented in **Table 9-192**. During all months of the year, the long-term average and average location of X2 by water year would remain essentially equivalent during most months under NEPA Modified Flow Alternative, relative to the NEPA No Project Alternative over the 72-year simulation period. Differences in X2 location under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would not exceed 0.4 percent (Appendix F4, 7 vs. 5, pg. 1189).

Table 9-192. Long-term Average Monthly Mean X2 Location (RK) from February Through June Under the NEPA Modified Flow Alternative and the NEPA No Action Alternative

Long-term Average[a] Monthly Mean X2 Location (RK)					
Alternative	Feb	Mar	Apr	May	Jun
NEPA Modified Flow Alternative	72.2	67.0	66.4	68.1	70.6
NEPA No Action Alternative	72.1	66.9	66.3	68.0	70.4
[a] Over the 72-year simulation period					

There would be 5 additional occurrences under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative when the monthly mean X2 location would be upstream of river kilometer 81; 1 time in January of below normal years, 1 time February of above normal years and 1 time in dry water years, and 2 times in June of critical years. The magnitude of these upstream shifts in X2 location would be 1.3 km, 1.0 km, 0.6 km, 1.3 km, and 1.3 km (Appendix F4, 7 vs. 5, pg. 1192 through 1201). However, the frequency at which these shifts in X2 location would occur would be unlikely to substantially impact water quality or beneficial uses in the Delta.

Delta outflow objectives established in SWRCB D-1641 extend throughout the year. For the February though June period under the NEPA Modified Flow Alternative, Delta outflow objectives are met by compliance with the X2 objective. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Overall, simulated changes in the monthly mean X2 location under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative, would not be of sufficient magnitude or frequency to adversely impact water quality resources in the Delta. Therefore, the NEPA Modified Flow Alternative would result in a less than significant impact on Delta water quality.

Impact 9.2.9-10: Changes to monthly mean Delta outflow that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

As described above, Delta outflow objectives established in SWRCB D-1641 extend throughout the year and are met by compliance with the X2 objective during the February though June period. Delta outflow objectives are met during the remaining months of the year by a minimum outflow schedule, as defined in the SWRCB D-1641. Over the entire 72-year period of simulated October through September outflows, differences in long-term average Delta outflows and average monthly outflows by water year type under the NEPA Modified Flow

[68] Also referred to as Collinsville.

[69] Also referred to as the Port Chicago EC monitoring station.

Alternative, relative to the NEPA No Action Alternative would not exceed 5 percent, which would occur during May of a critical water year (5,362 vs. 5,670 cfs, respectively) (Appendix F4, 7 vs. 5, pg. 1140). Average monthly flows under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative would meet minimum outflow requirements, as defined in the SWRCB D-1641. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-11: Changes to the monthly mean E/I ratios that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The Delta E/I ratio limits, established in SWRCB D-1641, specify that up to 35 percent of Delta inflows may be exported during the February through June period, and up to 65 percent of Delta inflows may be exported during the remaining months (i.e., July through January). These limits would be consistently met under both the NEPA Modified Flow Alternative and the NEPA No Project Alternative. In addition, there would be no measurable differences in average monthly E/I ratios between the NEPA Modified Flow Alternative and the NEPA No Action Alternative during most months, and differences that would occur would not exceed 2 percent except during May and June of critical years when E/I ratios would be 4 percent (E/I = 1) higher and 17 percent (E/I = 3) lower (Appendix F4, 7 vs. 5, pg. 1238). Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-12: Salinity changes in the Sacramento River at Emmaton that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Emmaton during the April through August period range from 450 to 2,780 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Emmaton under the NEPA Modified Flow Alternative, relative to the No Action Alternative, would range from 1.0 percent lower in August (15 µS/cm) and September (20 µS/cm)to 6.5 percent (32 µS/cm) higher in May. Average salinities by water year type would decrease by four percent or more (up to 7.7 percent (141 µS/cm)) during September of above normal years. Average salinities by water year type would increase by five percent or more (up to 9.2 percent (31 µS/cm)) during May of dry years (Appendix F5, 7 vs. 5, pg. 1).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Modified Flow Alternative would be lower than the NEPA No Action Alternative by ten percent or more (up to 14.6 percent (257 µS/cm)) during 3 of the 192 months modeled, and would be higher by ten percent or more (up to 22.5 percent (175 µS/cm)) during 9 of the 192 months modeled. Under the NEPA Modified Flow Alternative and NEPA No Action Alternative, modeled EC values between April and August would comply with D-1641 standards with equal probability. In addition, during the 12 modeled months in which neither alternative is compliant with D-1641 standards, EC conditions would measurably improve (by up to 8.3 percent (186 µS/cm)) under the NEPA Modified Flow Alternative during 7 months, and measurably decline (by up to 13.4 percent (107 µS/cm) during 3 months.

Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-193**).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-194**).

Table 9-193. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, by Water Year Type, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	341 – 1,387	6 - 16	Jan (1), May (2), Jun (2), Jul (1), Aug (1)
Critical	576 - 4,394	5 - 23	Oct (1), Mar (1), May (3), Jun (3), Jul (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

Table 9-194. Differences in Monthly Mean Salinity (µS/cm) in the Sacramento River at Emmaton, for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
	NEPA No Action Alternative				NEPA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	1,339	1,296	785	368	1,349	1,317	781	367	11 (1%)	21 (2%)	-4 (-1%)	-1 (0%)
1987	2,002	1,103	499	237	1,855	1,000	485	237	-148 (-7%)	-104 (-9%)	-14 (-3%)	-1 (0%)
1990	1,562	822	526	536	1,581	740	496	576	19 (1%)	-82 (-10%)	-30 (-6%)	39 (7%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-13: Salinity changes in the San Joaquin River at Jersey Point that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Depending on the water year type, applicable EC objectives for Jersey Point during the April through August period range from 450 to 2,200 µS/cm. During other months (i.e., September through March), there are no EC objectives at this location.

Long-term average salinities at Jersey Point under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from 1.0 percent (11 µS/cm) lower in January to 4.2 percent (16 µS/cm) higher in May. In addition average salinities by water year type would decrease by five percent or more (5.6 percent (128 µS/cm)) during September of above normal years and would increase by five percent or more (6.0 percent (43 µS/cm)) during May of critical years (Appendix F5, 7 vs. 5, pg. 14).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Modified Flow Alternative would be lower than the NEPA No Action Alternative by ten percent or more (up to 10.8 percent (236 µS/cm)) during 2 of the 192 months modeled, and higher by ten percent or more (up to 17.2 percent (90 µS/cm)) during 6 of the 192 months modeled. As a result of the decreases in monthly average salinities under the NEPA Modified Flow Alternative, modeled The EC values between April and August under the NEPA Modified Flow Alternative and the NEPA No Action Alternative would comply with D-1641 standards with equal probability. In addition, during the 23 months in which neither alterative would comply with D-1641 salinity standards, EC conditions would measurably improve (by up to 4.7 percent (143 µS/cm)) under the NEPA Modified Flow Alternative during 2 months, and measurably decline (by up to 14.2 percent (259 µS/cm)) during 16 months (Appendix F5, 7 vs. 5, pg. 15 through 26). Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-195**).

Table 9-195. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, by Water Year Type, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	Increases ≥ 5% (min - max)[a]	% Difference (min - max)[a]	Month(s) and Number of Occurrences[b]
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	303 – 2,381	6 - 14	Jan (1), May (2), Jun (2), Jul (1), Aug (1), Sep (1)
Critical	417 – 2,258	8 - 17	May (2), Jun (2), Jul (1), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-196**).

Table 9-196. Differences in Monthly Mean Salinity (µS/cm) in the San Joaquin River at Jersey Point, for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
	NEPA No Action Alternative				NEPA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	2,394	1,983	1,346	606	2,359	1,938	1,327	603	-34 (-1%)	-45 (-2%)	-19 (-1%)	-3 (0%)
1987	1,940	1,475	1,120	454	1,761	1,320	1,075	448	-179 (-9%)	-156 (-11%)	-45 (-4%)	-5 (-1%)
1990	1,848	1,753	1,088	641	1,823	1,629	997	640	-25 (-1%)	-124 (-7%)	-91 (-8%)	0 (0%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-14: Salinity changes in the San Joaquin River at Airport Way Bridge (Vernalis) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Airport Way Bridge (Vernalis) are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the NEPA Modified Flow Alternative would indicate no change in EC values, relative to the NEPA No Action Alternative (Appendix F5, 7 vs. 5, pg. 27). Similarly, monthly average salinities would also be identical under each alternative, and consequently do not indicate changes in the ability to meet D-1641 compliance standards. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-15: Salinity changes in the San Joaquin River at Brandt Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the San Joaquin River at Brandt Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities and average salinities by water year type under the NEPA Modified Flow Alternative would have only negligible changes in EC values (i.e., up to 0.2 percent (2 µS/cm)), relative to the NEPA No Action Alternative (Appendix F5, 7 vs. 5, pg. 40). Monthly average salinities also would remain similar under each alternative, with only 7 of the 192 months modeled indicating any difference and a maximum relative change of 1.0 percent (6 µS/cm) (Appendix F5, 7 vs. 5, pg. 41 through 52). Consequently, monthly average salinities would meet D-1641 compliance standards. Therefore, implementation of the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-16: Salinity changes in Middle River near Old River that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Middle River near Old River are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities at Middle River under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from 0.7 percent (3 µS/cm) lower in February to 1.2 percent (5 µS/cm) higher in August. In addition, changes in average salinities by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would not exceed 3 percent (10 µS/cm) (Appendix F5, 7 vs. 5, pg. 53). Monthly average salinities under both alternatives would comply with D-1641 standards. Therefore, implementation of the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-17: Salinity changes in Old River at Tracy Road Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

During all water year types, applicable EC objectives for the Old River at Tracy Road Bridge are 700 µS/cm during the April through August period, and 1,000 µS/cm during the September through March period.

Long-term average salinities under the NEPA Modified Flow Alternative would range from less than or equal to 1 percent (0 µS/cm to 4 µS/cm lower) from October through May and September to 1.6 percent (7 µS/cm and 9 µS/cm) higher in June and August. In addition, changes in average salinities by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would not exceed 3.0 percent (18 µS/cm) (Appendix F5, 7 vs. 5, pg. 66). Monthly average salinities under both alternatives would comply with D-1641 standards. Therefore, implementation of the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-18: Salinity changes in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

CCWD's Los Vaqueros Intake and pumping plant is located just upstream of the Highway 4 Bridge. Because the Los Vaqueros Intake is located directly on Old River and is several miles upstream from the mouth of Rock Slough, the EC measurements at the Los Vaqueros Intake are usually lower than corresponding EC measurements at CCWD's Pumping Plant #1 (Reclamation and DWR 2005). Los Vaqueros Reservoir is used to provide emergency storage and water quality "blending" water to reduce chloride concentrations in CCWD's delivered water. As described in Reclamation's OCAP (Reclamation 2004), CCWD only is able to fill Los Vaqueros Reservoir when water quality conditions in the Delta are good, which generally occurs from January through July. There are no applicable EC objectives for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641.

Long-term average salinities at Highway 4 under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from less than 1 percent (0.2 µS/cm to 5 µS/cm lower) from October through May and September to 2.8 percent (11 µS/cm) higher in July. Average salinities by water year type would increase by five percent or more (4.9 percent (26 µS/cm)) during July of critical years (Appendix F5, 7 vs. 5, pg. 79).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Modified Flow Alternative would be lower than the NEPA No Action Alternative by ten percent or more (up to 12.5 percent (87 µS/cm)) during 1 of the 192 months modeled, and higher by ten percent or more (up to 15.8 percent (77 µS/cm)) during 2 of the 192 months modeled (Appendix F5, 7 vs. 5, pg. 81 through 91).

Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-197**).

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-198**).

Table 9-197. Differences in Monthly Mean Salinity (µS/cm) in the Old River at Highway 4 (Los Vaqueros Intake), by Water Year Type, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	---	---	__
Above Normal	---	---	---
Below Normal	---	---	---
Dry	363 - 776	6 - 12	Jun (1), Jul (1), Aug (1), Sep (1)
Critical	380 - 771	6 - 16	Jun (2), Jul (2), Aug (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

Table 9-198. Differences in Monthly Mean Salinity (µS/cm) in Old River at Highway 4 (CCWD Los Vaqueros Intake), for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
	NEPA No Action Alternative				**NEPA Modified Flow Alternative**				**Absolute Difference (Relative Difference)[a]**			
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	787	856	737	453	769	839	718	449	-19 (-2%)	-18 (-2%)	-20 (-3%)	-4 (-1%)
1987	695	594	605	402	679	535	574	396	-16 (-2%)	-59 (-10%)	-32 (-5%)	-6 (-1%)
1990	620	701	689	460	616	671	638	449	-3 (-1%)	-30 (-4%)	-51 (-7%)	-11 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-19: Salinity changes at CCWD Pumping Plant #1 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Sources of chlorides in Rock Slough include seawater, which intrudes into the Delta when freshwater outflow from the Delta is low, local drainage and seepage from adjacent lands, and the Sacramento and San Joaquin rivers. However, seawater and local drainage are of primary concern (DWR 2003b). There are no applicable EC objectives for CCWD Pumping Plant #1 noted in D-1641.

Long-term average salinities at CCWD Pumping Plant #1 under the NEPA Modified Flow Alternative, relative to the No Project Alternative, would range from less than 1 percent (0.1 µS/cm to 5.5 µS/cm lower) in October through May and September to 2.8 percent (10 µS/cm) higher in June. Average salinities by water year type would increase by 5 percent (26 µS/cm) during June of critical years (Appendix F5, 7 vs. 5, pg. 92).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Modified Flow Alternative would be lower than the NEPA No Action Alternative by ten percent or more (up to 13.9 percent (116 µS/cm)) during 2 of the 192 months modeled, would be higher than the NEPA No Action Alternative by ten percent or more (up to 17.3 percent (100 µS/cm)) during 4 of the 192 months modeled (Appendix F5, 7 vs. 5, pg. 93 through 104).

Model output demonstrates that increases in salinity equal to or greater than five percent under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative, generally would occur during dry and critical years (**Table 9-199**).

Table 9-199. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, by Water Year Type, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Salinity Change (µS/cm)			
Water Year	**Increases ≥ 5% (min - max)[a]**	**% Difference (min - max)[a]**	**Month(s) and Number of Occurrences[b]**
Wet	---	---	---
Above Normal	---	---	---
Below Normal	---	---	---
Dry	724 - 930	6 - 12	Jul (1), Aug (1), Sep (1)
Critical	381 - 888	7 - 17	Jun (2), Jul (1), Aug (1), Sep (1)

[a] Values represent the minimum and maximum salinities occurring in a particular water year type over the 16-year simulation period.
[b] Values in parentheses represent the number of occurrences in which monthly mean salinity is equal to or greater than 5 percent., relative to the basis of comparison.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-200**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Table 9-200. Differences in Monthly Mean Salinity (µS/cm) in the CCWD Pumping Plant #1, for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
	NEPA No Action Alternative				**NEPA Modified Flow Alternative**				**Absolute Difference (Relative Difference)[a]**			
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	886	1,005	865	459	865	985	841	455	-22 (-2%)	-20 (-2%)	-24 (-3%)	-4 (-1%)
1987	793	659	693	434	784	587	655	427	-9 (-1%)	-72 (-11%)	-38 (-5%)	-7 (-2%)
1990	686	786	765	480	682	754	705	465	-4 (-1%)	-32 (-4%)	-60 (-8%)	-14 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.9-20: Salinity changes in the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The SWP Banks Pumping Plant supplies water to the South Bay Aqueduct and the California Aqueduct. The applicable EC objective for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 1,000 µS/cm between October and September.

Long-term average salinities at Clifton Court Forebay under the NEPA Modified Flow Alternative, relative to the No Project Alternative, range from less than 1 percent (0.1 µS/cm to 3 µS/cm lower) in October through May and September to 2.5 percent (9 µS/cm and 11 µS/cm) higher in July and August. Average salinities by water year type would not exceed five percent or more (Appendix F5, 7 vs. 5, pg. 105).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Modified Flow Alternative would be lower than the NEPA No Action Alternative by ten percent (11.1 percent (67 µS/cm)) during 1 of the 192 months modeled and higher than the NEPA No Action Alternative by ten percent or more (up to 12.8 percent (61 µS/cm)) during 2 of the 192 months modeled (Appendix F5, 7 vs. 5, pg. 106 through 117). Modeled monthly average EC values under both alternatives between October and September would consistently comply with D-1641 standards.

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-201**).

Table 9-201. Differences in Monthly Mean Salinity (µS/cm) in the West Canal at the Mouth of Clifton Court Forebay (SWP Intake), for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Salinity (µS/cm)												
	NEPA No Action Alternative				NEPA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	682	766	705	509	667	751	691	506	-15 (-2%)	-16 (-2%)	-14 (-2%)	-4 (-1%)
1987	620	588	597	505	613	554	571	502	-7 (-1%)	-33 (-6%)	-26 (-4%)	-3 (-1%)
1990	583	620	662	544	582	598	618	547	-1 (0%)	-23 (-4%)	-44 (-7%)	3 (1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-21: Salinity changes in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

The Delta-Mendota Canal at the Jones Pumping Plant supplies drinking water to Jones and other communities. The applicable EC objective for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 1,000 µS/cm between October and September.

Long-term average salinities at Jones Pumping Plant under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from less than 1 percent (0.1 µS/cm higher to 3 µS/cm lower) in October through May and September to 1.6 percent (7 µS/cm) higher in June. In addition, average salinities by water year type would not exceed four percent (17 µS/cm) or more during any month or water year type (Appendix F5, 7 vs. 5, pg.

118). Modeled monthly average EC values under both alternatives between October and September would consistently comply with D-1641 standards (Appendix F5, 7 vs. 5, pg. 119 through 130). Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-22: Salinity changes at Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Middle River at Victoria Canal is an indicator of central Delta water quality and the water quality reach Victoria Island agricultural siphons. There are no applicable EC objectives for Middle River at Victoria Canal noted in D-1641.

Long-term average salinities at Victoria Canal under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from less than 1 percent (0 µS/cm to 2 µS/cm lower) in October through May and September to 2.0 percent (7 µS/cm) higher in July. Average salinities by water year type would not exceed five percent or more during any month or water year type (Appendix F5, 7 vs. 5, pg. 131).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Modified Flow Alternative would not be lower than the No Project Alternative by ten percent or more, and would be higher by ten percent or more (10.5 percent (39 µS/cm)) during 1 of the 192 months modeled (Appendix F5, 7 vs. 5, pg. 132 through 143). This increase in salinity under the NEPA Modified Flow Alternative would not occur with enough frequency to substantially impact water quality or beneficial uses. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-23: Salinity changes at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no applicable EC objectives for the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns related to the City of Stockton's water supply intake.

Long-term average salinities at the Stockton Intake under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from less than 1 percent (0.2 µS/cm higher to 2 µS/cm lower) in October through May and September to 2.0 percent (6 µS/cm) higher in July. Average salinities by water year type would not exceed five percent or more during any month or water year type (Appendix F5, 7 vs. 5, pg. 144).

Over the entire 16-year simulation period, monthly average salinities under the NEPA Modified Flow Alternative would not be lower than the NEPA No Action Alternative by ten percent or more, but would be higher by ten percent or more (up to 10.8 percent (33 µS/cm)) during 2 of the 192 months modeled (Appendix F5, 7 vs. 5, pg. 145 through 156). This increase in salinity under the NEPA Modified Flow Alternative would not occur with enough frequency to substantially impact water quality or beneficial uses. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-24: Changes in chloride concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objective for Old River at Highway 4 (CCWD Los Vaqueros Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake.

Long-term average chloride ion concentrations at Highway 4 under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would range from 1.2 percent lower (2 µS/cm) in January to 5.2 percent (3 µS/cm) higher in July. Differences in average chloride ion concentration by water year type under the NEPA Modified Flow Alternative would not exceed about 5 percent except during February of dry years when they would be about 11 percent (11 µS/cm) lower, during September of above normal years when they would be about 5 percent (6 µS/cm) lower, during June of dry years when they would be about 6 percent higher (2 µS/cm), and during June, July, and August of critical years when they would be about 6 (6 µS/cm) to 7 (7 µS/cm) percent higher (Appendix F5, 7 vs. 5, pg. 157).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 23 of the 192 months modeled. During these 23 months, chloride ion concentrations would be higher under the NEPA Modified Flow Alternative on 16 occasions and lower on 7 occasions, relative to the NEPA No Action Alternative. Differences in monthly average chloride ion concentrations under the NEPA Modified Flow Alternative would be lower by ten percent or more (up to 39.5 percent (48 µS/cm)) during 4 of the 192 months modeled and higher by ten percent or more (up to 24.6 percent (22 µS/cm)) during 7 of the 192 months modeled (Appendix F5, 7 vs. 5, pg. 158 through 169). Monthly average chloride ion concentrations from October through September are presented in **Table 9-202**.

Table 9-202. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake) from October Through September Over the 16-year Simulation Period Under the NEPA Modified Flow Alternative and the NEPA No Project Alternative

	Monthly Average Chloride Ion Concentration (mg/l)											
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA Modified Flow Alternative	141.8	125.9	115.6	108.2	77.2	49.7	40.4	42.4	47.6	61.3	85.7	124.8
NEPA No Project Alternative	143.4	125.8	116.1	109.5	80.4	49.8	40.3	42.2	45.3	58.3	82.8	123.9

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-203**).

Table 9-203. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Highway 4 (CCWD Los Vaqueros Intake, for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

	Monthly Mean Chloride Ion Concentration (mg/l)											
	NEPA No Action Alternative				NEPA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	174	194	160	79	169	189	155	78	-5 (-3%)	-5 (-3%)	-6 (-3%)	-1 (-1%)
1987	148	119	122	48	143	103	113	47	-5 (-3%)	-17 (-14%)	-9 (-7%)	-1 (-2%)
1990	127	150	146	57	126	141	132	55	-1 (-1%)	-8 (-6%)	-14 (-10%)	-2 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-25*: *Changes in chloride concentrations in CCWD Pumping Plant #1 (Rock Slough) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for CCWD Pumping Plant #1 (Rock Slough) is 150 mg/l year-round.

Long-term average chloride ion concentrations at the CCWD Pumping Plant #1 under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from 1.2 percent (2 mg/l) lower in October to 5.6 percent (2 mg/l) higher in June. Differences in average chloride ion concentration by water year type would not exceed 5 percent except during June of dry years when they would be about 7 percent (3 mg/l) higher and in June, July, and August of critical years when they would be about 5 percent (6 mg/l) to 8 percent (8 mg/l) higher (Appendix F5, 7 vs. 5, pg. 170).

Over the entire 16-year simulation period, monthly average chloride concentrations under both alternatives exceed 150 mg/l during 49 of the 192 months modeled. There would be one additional occurrence under the NEPA Modified Flow Alternative when chloride concentrations would exceed 150 mg/l. Differences in chloride ion concentrations would be equal to or greater than 5 percent during 23 of the 192 months modeled. During these 23 months, chloride ion concentrations would be higher under the NEPA Modified Flow Alternative on 17 occasions and lower on 6 occasions, relative to the NEPA No Action Alternative. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 10 of the 192 months modeled, and would be higher on 7 (up to 25.0 percent (28 mg/l)) occasions and lower on 3 (up to 17.7 percent (33 mg/l)) occasions under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (Appendix F5, 7 vs. 5, pg. 184 through 195). Monthly average chloride ion concentrations from October through September are presented in **Table 9-204**.

Table 9-204. Monthly Mean Chloride Ion Concentrations (mg/l) at CCWD Pumping Plant #1 (Rock Slough) from October Through September Over the 16-year Simulation Period Under the NEPA Modified Flow Alternative and the NEPA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA Modified Flow Alternative	167.6	149.0	133.6	126.6	97.9	66.8	58.6	45.3	50.5	74.1	105.7	144.0
NEPA No Project Alternative	169.5	149.6	134.0	127.6	98.6	66.9	58.5	45.0	47.8	70.9	102.2	142.6

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-205**).

Table 9-205. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at CCWD Pumping Plant #1 (Rock Slough), for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
	NEPA No Action Alternative				NEPA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	166	182	152	81	163	179	149	80	-3 (-2%)	-3 (-2%)	-4 (-2%)	-1 (-1%)
1987	173	137	120	66	169	117	111	65	-4 (-3%)	-20 (-15%)	-8 (-7%)	-1 (-2%)
1990	145	156	129	74	144	149	117	72	-1 (-1%)	-7 (-5%)	-11 (-9%)	-2 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-26: Changes in chloride concentrations in Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives for Old River at Rock Slough (CCWD Intake) noted in D-1641. However, this location is evaluated to address potential water quality concerns related to CCWD's water supply intake. Long-term average chloride ion concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from 4.3 percent (4 mg/l) lower in February to 7.1 percent (3 mg/l) higher in June. Differences in average chloride ion concentration by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would not exceed about 5 percent except during February of dry years when they would be about 11 percent (12 mg/l) lower, June of dry years when they would be about 8 percent (2 mg/l) higher, and June and July of critical years when they would be about 7 percent (8 mg/l) and 8 percent (8 mg/l) higher (Appendix F5, 7 vs. 5, pg. 183).

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 250 mg/l under either the NEPA Modified Flow Alternative or the NEPA No Action Alternative. However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 25 of the 192 months modeled. During these 25 months, chloride ion concentrations would be higher under the NEPA Modified Flow Alternative on 18 occasions and lower on 7 occasions. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 12 of the 192 months modeled, and would be higher on 8 (up to 25.5 percent (26 mg/l)) occasions and lower on 4 (up to 40.1 percent (51 mg/l)) occasions under the NEPA Modified Flow Alternative (Appendix F5, 7 vs. 5, pg. 184 through 195). Monthly average chloride ion concentrations from October through September are presented in **Table 9-206**.

Table 9-206. Monthly Mean Chloride Ion Concentrations (mg/l) in Old River at Rock Slough (CCWD Intake) from October Through September Over the 16-year Simulation Period Under the NEPA Modified Flow Alternative and the NEPA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA Yuba Accord Alternative	162.9	139.9	133.0	114.6	76.9	42.8	32.5	34.5	43.2	69.5	102.1	150.3
NEPA No Project Alternative	164.9	140.1	133.6	116.1	80.3	43.0	32.4	34.2	40.4	65.9	98.8	149.5

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-207**).

Table 9-207. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Old River at Rock Slough (CCWD Intake), for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	NEPA No Action Alternative				NEPA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	211	217	167	65	204	212	161	64	-7 (-3%)	-6 (-3%)	-6 (-4%)	-1 (-1%)
1987	170	129	128	42	162	108	118	41	-8 (-5%)	-21 (-16%)	-10 (-8%)	-1 (-2%)
1990	145	175	147	50	143	164	131	49	-2 (-1%)	-11 (-6%)	-16 (-11%)	-2 (-3%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-27: Changes in chloride concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) is 250 mg/l year round.

Long-term average chloride ion concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from 3.3 percent (2 mg/l) lower in February to 4.4 percent (2 mg/l) higher in August. Differences in average chloride ion concentration by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would not exceed about 5 percent except during February of dry years when they would be about 9 percent (8 mg/l) lower and in July and August of critical years when they would be about 7 percent (6 mg/l and 5 mg/l) higher (Appendix F5, 7 vs. 5, pg. 196).

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 250 mg/l under either the NEPA Modified Flow Alternative or the NEPA No Action Alternative. However, differences in chloride ion concentrations would be equal to or greater than 5 percent during 18 of the 192 months modeled. During these 18 months, chloride ion concentrations would be higher under the NEPA Modified Flow Alternative on 12 occasions and lower on 6 occasions, relative to the NEPA No Action Alternative. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 6 of the 192 months modeled, and would be higher on 3 (up to 19.1 percent (15 mg/l)) occasions and lower on 3 (up to 32.2 percent (34 mg/l)) occasions under the NEPA Modified Flow Alternative (Appendix F5, 7 vs. 5, pg. 197 through 208). Monthly average chloride ion concentrations from October through September are presented in **Table 9-208**.

Table 9-208. Monthly Mean Chloride Ion Concentrations (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant) from October Through September Over the 16-year Simulation Period Under the NEPA Modified Flow Alternative and the NEPA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
NEPA Modified Flow Alternative	107.3	102.4	91.3	88.5	67.7	49.8	40.9	42.4	47.5	51.5	66.9	92.1
NEPA No Project Alternative	108.1	102.3	91.5	89.3	70.0	50.0	40.9	42.3	46.5	49.3	64.3	92.1

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-209**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Table 9-209. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in West Canal at the Mouth of Clifton Court Forebay (SWP Banks Pumping Plant), for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
	NEPA No Action Alternative				**NEPA Modified Flow Alternative**				**Absolute Difference (Relative Difference)[a]**			
Year	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**	**Dec**	**Jan**	**Feb**	**Mar**
1976	127	154	135	83	124	150	130	82	-4 (-3%)	-4 (-2%)	-4 (-3%)	-1 (-2%)
1987	116	101	104	54	115	90	97	53	-2 (-1%)	-11 (-11%)	-7 (-7%)	-1 (-2%)
1990	102	113	131	62	101	108	119	60	0 (0%)	-5 (-5%)	-11 (-9%)	-2 (-4%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.9-28: Changes in chloride concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

The applicable chloride ion concentration objective under D-1641 for the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) is 250 mg/l year-round.

Long-term average chloride ion concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from 3.5 percent (3 mg/l) lower in February to 2.6 percent (2 mg/l) higher in June. Differences in average chloride ion concentration by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would not exceed approximately 5 percent except during February of dry years when they would be about 9 percent (9 mg/l) lower (Appendix F5, 7 vs. 5, pg. 209).

Over the entire 16-year simulation period, monthly average chloride concentrations would not exceed 250 mg/l under either the NEPA Modified Flow Alternative or the NEPA No Action Alternative. However, differences in chloride ion concentrations would be equal to or greater than 5 percent occur during 14 of the 192 months modeled. During these 14 months, chloride ion concentrations would be higher under the NEPA Modified Flow Alternative on 9 occasions and lower on 5 occasions, relative to the NEPA No Action Alternative. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 4 of the 192 months modeled, and would be higher (up to 11.2 percent (13 mg/l)) on 2 occasions and lower (up to 31.5 percent (38 mg/l)) on 2 occasions under the NEPA Modified Flow Alternative (Appendix F5, 7 vs. 5, pg. 210 through 221). Monthly average chloride ion concentrations from October through September are presented in **Table 9-210**.

Table 9-210. Monthly Mean Chloride Ion Concentrations (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant)from October Through September Over the 16-year Simulation Period Under the NEPA Accord Alternative and the NEPA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA Modified Flow Alternative	108.7	101.7	93.1	89.0	69.0	62.2	48.3	48.3	63.2	70.3	86.4	119.3
NEPA No Project Alternative	109.4	101.7	93.3	89.5	71.5	62.2	48.3	48.2	61.6	68.7	84.9	119.4

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-211**).

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Table 9-211. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant), for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
	NEPA No Action Alternative				NEPA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
Year	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	123	144	139	115	120	141	137	115	-3 (-2%)	-3 (-2%)	-2 (-2%)	-1 (-1%)
1987	113	115	120	85	112	111	116	85	-1 (-1%)	-4 (-4%)	-4 (-3%)	0 (0%)
1990	109	119	135	82	109	115	126	82	0 (0%)	-4 (-4%)	-9 (-7%)	0 (-1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

Impact 9.2.9-29: Changes in chloride concentrations in Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives in Middle River at Victoria Canal noted in D-1641. However, Middle River at Victoria Canal is an indicator of central Delta water quality and water quality at the Victoria Island agricultural siphons, and is therefore evaluated.

Long-term average chloride ion concentrations in Middle River at Victoria Canal under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from 2.8 percent (2 mg/l) lower in February to 3.9 percent (2 mg/l) higher in July. Differences in average chloride ion concentration by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would not exceed approximately 5 percent except during February of dry years when they would be about 8 percent (6 mg/l) lower and June and July of critical years when they would be about 5 percent (4 mg/l) and 7 percent (5 mg/l) higher (Appendix F5, 7 vs. 5, pg. 222).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 18 of the 192 months modeled. During these 18 months, chloride ion concentrations would be higher under the NEPA Modified Flow Alternative on 12 occasions and lower on 6 occasions, relative to the NEPA No Action Alternative. Differences in chloride ion concentrations equal to or greater than 10 percent occur during 6 of the 192 months modeled, and would be higher (up to 18.4 percent (10 mg/l)) on 5 occasions and lower by about 29 percent (26 mg/l) on 1 occasion under the NEPA Modified Flow Alternative (Appendix F5, 7 vs. 5, pg. 223 through 234). Monthly average chloride ion concentrations from October through September are presented in **Table 9-212**.

Table 9-212. Monthly Mean Chloride Ion Concentrations (mg/l) in Middle River at Victoria Canal from October Through September Over the 16-year Simulation Period Under the NEPA Modified Flow Alternative and the NEPA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA Modified Flow Alternative	74.7	76.3	67.9	72.1	59.9	49.5	44.3	46.9	47.9	42.3	48.2	62.4
NEPA No Project Alternative	75.0	76.3	68.1	72.7	61.6	49.6	44.3	46.8	46.5	40.7	47.1	62.6

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-213**).

Table 9-213. Differences in Monthly Mean Chloride Ion Concentration (mg/l) in Middle River at Victoria Canal, for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	NEPA No Action Alternative				NEPA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	84	111	107	80	82	108	105	79	-2 (-2%)	-2 (-2%)	-3 (-3%)	-1 (-1%)
1987	86	79	88	55	86	73	83	54	0 (0%)	-6 (-8%)	-5 (-6%)	-1 (-1%)
1990	75	80	109	60	75	77	101	59	0 (0%)	-3 (-4%)	-8 (-7%)	-1 (-2%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-30: Changes in chloride concentrations at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There is no applicable chloride ion concentration objectives at the Stockton Intake noted in D-1641. However, this location is evaluated to address potential water quality concerns associated with the City of Stockton's water supply intake.

Long-term average chloride ion concentrations at the Stockton Intake under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from 2.6 percent lower (1.3 mg/l) in February to 4.5 percent (1.3 mg/l) higher in July. Differences in average chloride ion concentration by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would not exceed approximately 5 percent except during February of dry years when they would be about 6 percent (4 mg/l) lower, September of above normal years when they would be about 5 percent (2 mg/l) lower, and June and July of critical years when they would be about 7 percent (3 mg/l) higher (Appendix F5, 7 vs. 5, pg. 235).

Over the entire 16-year simulation period, differences in chloride ion concentrations equal to or greater than 5 percent occur during 20 of the 192 months modeled. During these 20 months, chloride ion concentrations would be higher under the NEPA Modified Flow Alternative on 12 occasions and lower on 8 occasions, relative to the NEPA No Action Alternative. Differences in monthly average chloride ion concentrations under the NEPA Modified Flow Alternative would be lower than the NEPA No Action Alternative by ten percent or more (up to 26.1 percent (18 mg/l)) during 3 of the 192 months modeled and higher by ten percent or more (up to 22.3 percent (8 mg/l)) during 6 of the 192 months modeled (Appendix F5, 7 vs. 5, pg. 236

through 247). Monthly average chloride ion concentrations from October through September are presented in **Table 9-214**.

Table 9-214. Monthly Mean Chloride Ion Concentrations (mg/l) at the Stockton Intake from October Through September Over the 16-year Simulation Period Under the NEPA Modified Flow Alternative and the NEPA No Project Alternative

Monthly Average Chloride Ion Concentration (mg/l)												
Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEPA Modified Flow Alternative	59.8	56.9	54.4	57.1	47.6	37.9	38.6	40.4	30.6	30.7	37.0	51.7
NEPA No Project Alternative	60.1	56.8	54.6	57.7	48.9	37.9	38.5	40.2	29.4	29.4	36.0	51.9

As previously described, simplifying assumptions, used to evaluate effects of the various alternatives, could require additional, more refined assumptions to assess impacts to specific periods. Through a refinement of the New Bullards Bar Reservoir target operating line (see Appendix D) for the NEPA No Action Alternative in December, January, February and March of 1976, 1987, and 1990, additional, refined modeling shows that impacts to Delta water quality during those months would typically be substantially reduced or eliminated (**Table 9-215**).

Table 9-215. Differences in Monthly Mean Chloride Ion Concentration (mg/l) at the Stockton Intake, for Periods with Refined Modeling Assumptions, Under the NEPA Modified Flow Alternative, Compared to the NEPA No Action Alternative

Monthly Mean Chloride Ion Concentration (mg/l)												
Year	NEPA No Action Alternative				NEPA Modified Flow Alternative				Absolute Difference (Relative Difference)[a]			
	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar	Dec	Jan	Feb	Mar
1976	80	94	87	50	77	91	84	50	-3 (-3%)	-3 (-3%)	-3 (-3%)	-1 (-1%)
1987	66	60	69	39	64	53	65	38	-2 (-3%)	-7 (-12%)	-4 (-6%)	0 (-1%)
1990	58	76	86	42	58	71	78	42	0 (-1%)	-4 (-6%)	-8 (-9%)	-1 (-1%)

[a] Values in parentheses represent the relative difference in monthly mean salinity.

While refined modeling studies conducted for years showing impacts under the simplified modeling assumptions indicate, that despite more detailed examination, there could still be impacts, it is anticipated that real-time operational changes would further reduce the impacts to less than significant levels. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-31: Changes in DOC concentrations at Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

There are no DOC objectives noted in D-1641 for any location within the Delta. However, consideration of data regarding the average DOC concentrations in the Delta, assumed levels of natural variation, and assumed relationships between DOC concentrations and THM formation in drinking water has resulted in establishment of a monthly change significance criterion for DOC of 0.4 mg/l (see Section 9.2.2.1).

Long-term average DOC concentrations at Highway 4 under the NEPA Modified Flow Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the NEPA No Action Alternative during all months of the year (Appendix F5, 6 vs. 5, pg. 248). In addition, changes in average DOC concentrations by water year type under the NEPA Modified Flow

Alternative, relative to the NEPA No Action Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.2 mg/l. Consequently, changes in the monthly average DOC concentrations would not exceed the significance criteria, and therefore, implementation of the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-32: Changes in DOC concentrations at Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations in the Old River at Rock Slough under the NEPA Modified Flow Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the NEPA No Action Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.1 mg/l (Appendix F5, 7 vs. 5, pg. 261). Consequently, changes in the monthly average DOC concentrations would not exceed significance criteria, and therefore, implementation of the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-33: Changes in DOC concentrations at West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta

Long-term average DOC concentrations at Clifton Court Forebay under the NEPA Modified Flow Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the NEPA No Action Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.1 mg/l (Appendix F5, 7 vs. 5, pg. 274). Consequently, changes in the monthly average DOC concentrations would not exceed significance criteria, and therefore, implementation of the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-34: Changes in DOC concentrations at Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average DOC concentrations at Jones Pumping Plant under the NEPA Modified Flow Alternative would remain essentially equivalent (i.e., less than 0.1 mg/l change) to the NEPA No Action Alternative during all months of the year. In addition, changes in average DOC concentrations by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would not exceed 0.1 mg/l. Monthly average DOC concentrations also would remain similar under each alternative, with a maximum absolute change of 0.1 mg/l (Appendix F5, 7 vs. 5, pg. 287). Consequently, changes in the monthly average DOC concentrations would not exceed significance criteria, and therefore, implementation of the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-35: Changes in monthly mean flows in the Old River at Bacon Island that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows in the Old River at Bacon Island under the NEPA Modified Flow Alternative (1,446 cfs), relative to the NEPA No Action Alternative (1,520 cfs), would not exceed approximately 5 percent (73 cfs higher) during most months (Appendix F5, 7 vs. 5, pg. 300). The direction of flow under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative moves towards the Delta pumps during all months and water years except during April of wet years. The magnitude of flows moving towards Delta pumps during February through May of all water years would be essentially equivalent or reduced during most months and water years under the NEPA Modified Flow Alternative. In general, the magnitude of flows moving towards Delta pumps under the NEPA Modified Flow Alternative during wet, above normal, and below normal years is between about 2 cfs and about 160 cfs higher from July through September. Increases in the magnitude of flows moving towards Delta pumps occur less frequently in dry and critical years and would be between about 1 cfs and 100 cfs higher compared to the NEPA No Action Alternative.

Over the 16-year simulation period, flows under the NEPA Modified Flow Alternative would move towards Delta pumps at a higher magnitude (more negative flow) during 45 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 147 months (Appendix F5, 7 vs. 5, pg. 301 through 312).

Overall, potential changes in monthly mean flows under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-36: Changes in monthly mean flows in the Middle River at Middle River that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Differences in long-term average monthly flows and monthly flow by water year in the Middle River at Middle River would not exceed about 3 percent under the NEPA Modified Flow Alternative (2,038 cfs), relative to the NEPA No Action Alternative (2,085 cfs) (Appendix F5, 7 vs. 5, pg. 313). The direction of flow under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative moves towards the Delta pumps during all months and water years. The magnitude of flows moving towards Delta pumps under both alternatives during February through May would be reduced, and would be essentially equivalent during most months and water years.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 44 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 148 months (Appendix F5, 7 vs. 5, pg. 314 through 325).

Overall, potential changes in monthly mean flows under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-37: Changes in monthly mean flows in the Middle River at Mowry Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses

Long-term average monthly flows in the Middle River at Mowry Bridge would be essentially equivalent (0 cfs to 1 cfs) during most months under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (Appendix F5, 7 vs. 5, pg. 326). The direction of flow under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative moves away from the Delta pumps during most months of wet, above normal, and below normal water years. During dry and critical years flows under both alternatives move towards Delta pumps and would be essentially equivalent (less than 1 cfs) during most months. However, during these times they would be essentially equivalent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative.

Over the 16-year simulation period, flows would move towards Delta pumps at a higher magnitude (more negative flow) during 27 of the 192 months modeled, and would be essentially equivalent or less negative for the remaining 165 months (Appendix F5, 7 vs. 5, pg. 327 through 338).

Overall, potential changes in monthly mean flows under the NEPA Modified Flow Alternative, compared to the NEPA No Action Alternative would not be of sufficient frequency and magnitude to cause long-term adverse effects to water quality or beneficial uses. Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on Delta water quality.

Impact 9.2.9-38: Decreases in San Luis Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses.

Historically, the CVP and SWP have cooperated to try to maintain San Luis Reservoir above 300 TAF in response to the low-point problem and thus, avoid adverse impacts to water quality. Combined long-term average monthly CVP and SWP reservoir storage would be essentially equivalent during most months, and up to 1 percent lower (2 TAF to 4 TAF) during some months). Combined CVP/SWP average monthly storage by water year type under the NEPA Modified Flow Alternative would be essentially equivalent except during below normal, dry, and critical years when storage would be up to 5 percent lower (up to 4 TAF lower) under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pg. 1339 and 1376). Differences in reservoir storage during all months and water years would not exceed 5 percent (4 TAF). In addition, there would be no additional months under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative when the combined CVP and SWP monthly mean reservoir storage drops below 300 TAF (Appendix F4, 7 vs. 5. pg. 1340 through 1351; and 1377 through 1388). Therefore, the NEPA Modified Flow Alternative would have a less than significant impact on water quality in San Luis Reservoir.

9.3 CUMULATIVE IMPACTS

Hydrologic modeling was used to evaluate the cumulative effects of the Yuba Accord Alternative and other likely changes in CVP/SWP operations on hydrology and water supply. The proposed projects that have been adequately defined (e.g., in recent project-level environmental documents or CALSIM II modeling) and that have the potential to contribute to cumulative impacts are included in the quantitative assessment of the Yuba Accord's impacts. For analytical purposes of this EIR/EIS, the projects that are considered well defined and "reasonably foreseeable" are described in Chapter 21. Additionally, the assumptions used to categorize future hydrologic cumulative conditions that are quantitatively simulated using CALSIM II and the post-processing tools are presented in Appendix D. To the extent feasible, potential cumulative impacts on resources dependent on hydrology or water supply (e.g., water quality) are analyzed quantitatively. Because several projects cannot be accurately characterized for hydrologic modeling purposes at this time, either due to the nature of the particular project or because specific operations details are only in the preliminary phases of development, these projects are evaluated qualitatively.

Only those projects that could affect surface water quality are included in the qualitative evaluation that is presented in subsequent sections of this chapter. Although most of the proposed projects described in Chapter 21 could have project-specific impacts that will be addressed in future project-specific environmental documentation, future implementation of these projects is not expected to result in cumulative impacts to regional water supply operations, or water-related and water dependent resources that also could be affected by the Proposed Project/Action or alternatives (see Chapter 21). For this reason, only the limited number of projects with the potential to cumulatively impact surface water quality in the project study area are specifically considered qualitatively in the cumulative impacts analysis for surface water quality:

- Water Storage and Conveyance Projects
  - Shasta Lake Water Resources Investigation (Shasta Reservoir Enlargement)
  - Upstream of Delta Off-Stream Storage (Sites Reservoir)
  - Upper San Joaquin River Storage Project
  - In-Delta Storage Program (Delta Wetlands Project)
  - Los Vaqueros Reservoir Expansion Project
  - Folsom Dam Raise Project
- Projects Related to CVP/SWP System Operations
  - South Delta Improvements Program (SDIP)
  - Delta Cross Channel Re-operation and Through-Delta Facility
  - Delta-Mendota Canal/California Aqueduct Intertie
  - Long-term CVP and SWP Operations Criteria and Plan
  - Central Valley Project Long-term Contract Renewals
  - CVP/SWP Integration Proposition
  - Isolated Delta Facility
  - Delta-Mendota Canal Recirculation Feasibility Study
  - Monterey Plus EIR
  - Sacramento River Water Reliability Study
  - City of Stockton Delta Water Supply Project
  - Oroville Facilities FERC Relicensing
- Water Transfer and Acquisition Programs
  - Dry Year Water Purchase Program
  - Delta Improvements Package
  - San Joaquin Valley/Southern California Water Exchange
- Ecosystem Restoration and Water Quality Improvement Projects
  - Bay Area Water Quality and Supply Reliability Program
  - Rock Slough and Old River Water Quality Improvement Project
  - Contra Costa Water District Alternative Intake Project
  - North Delta Flood Control and Ecosystem Restoration Project
  - North Bay Aqueduct Improvements

- San Luis Reservoir Low Point Improvement Project
- CALFED Ecosystem Restoration Program
- San Joaquin River Restoration Settlement Act (Friant Settlement Legislation)

- ❑ Local Projects in the Yuba Region
  - Yuba River Development Project FERC Relicensing

These projects are described in Chapter 21 and qualitatively addressed below.

9.3.1 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE YUBA ACCORD ALTERNATIVE CUMULATIVE CONDITION COMPARED TO THE EXISTING CONDITION

For CEQA, the purpose of the cumulative analysis is to determine whether the incremental effects of the Proposed Project (Yuba Accord Alternative) would be expected to be "cumulatively considerable" when viewed in connection with the effects of past projects, other current projects, and probable future projects (Public Resources Code Section 21083, subdivision (b)(2))[70].

For NEPA, the scope of an EIS must include "Cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement (40 CFR §1508.25(a)(2)).

Because CEQ regulations for implementing NEPA and the CEQA guidelines contain very similar requirements for analyzing, and definitions of, cumulative impacts, the discussions of cumulative impacts of the Yuba Accord Alternative Cumulative Condition relative to the Existing Condition will be the basis for evaluation of cumulative impacts for both CEQA and NEPA. In addition, an analysis of the Modified Flow Alternative Cumulative Condition relative to the Existing Condition is provided to fulfill NEPA requirements.

The following sections describe this analysis for the projects discussed in Section 9.3 above.

9.3.1.1 WATER STORAGE AND CONVEYANCE PROJECTS

Planned water storage projects would allow more water to be stored within the CVP/SWP system. The added storage would allow improved management of the CVP/SWP system by increasing operational flexibility and providing additional water supplies to meet Delta water quality objectives. Future storage reservoirs or expansions of existing reservoirs would not result in substantial changes in south Delta water quality because operating storage reservoirs typically involves storing river flows during high flow periods when water quality conditions are not a concern in the Delta, and releasing flows during high demand summer periods, when south Delta salinity and DO conditions are less desirable. Water storage and conveyance projects are not expected to significantly affect cumulative water quality conditions in the south Delta beyond those discussed for the Yuba Accord Alternative because operating these projects would require compliance with current Delta flow and water quality objectives.

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[70] The *"Guide to the California Environmental Quality Act"* (Remy *et. al.* 1999) states that *"…although a project may cause an "individually limited" or "individually minor" incremental impact that, by itself, is not significant, the increment may be "cumulatively considerable", and thus significant, when viewed against the backdrop of past, present, and probable future projects."* (CEQA Guidelines, § 15064, subd. (i)(l), 15065, subd. (c), 15355, subd. (b))."

9.3.1.2 PROJECTS RELATED TO CVP/SWP SYSTEM OPERATIONS

Future changes in water demands on CVP and SWP water supplies will affect CVP/SWP system operations, and could contribute to surface water quality impacts by altering reservoir storage and river flows as well as Delta inflow, export water supply pumping operations, and associated Delta outflow. Future river flow patterns and discharge rates would most likely be governed by established regulatory requirements for anadromous and riverine fish, through such agencies as USFWS and NMFS, which would prevent flows from increasing or decreasing in a manner that would be considered harmful to the fisheries. The fluctuations in flow caused by the cumulative actions would most likely not increase or decrease flows to cause a cumulatively significant impact to water quality.

9.3.1.3 WATER TRANSFER AND ACQUISITION PROGRAMS

Water transfer and acquisition programs also could contribute to changes in the timing and quantity of water released from reservoirs, inflow to the Delta, and the CVP/SWP's ability to meet Delta water quality objectives. The Yuba Accord Alternative would supplement existing water supplies and contract amounts, which previously were analyzed in Reclamation's 2004 OCAP and long-term contract renewal documents. Because additional water supply deliveries provided by the Yuba Accord Alternative would be within current CVP and SWP delivery allocations, Yuba Accord water would not be expected to contribute to increased water quality degradation by increasing the amount of agricultural runoff in the Export Service Area beyond that which was previously identified in existing environmental documentation. The anticipated changes in Table A annual allocations for SWP customers (i.e., changes less than 1 percent) under the Yuba Accord Alternative would not result in cumulative impacts on surface water quality.

The Yuba Accord Alternative analysis evaluated the potential impacts to rivers and reservoirs as percent changes in flow, reservoir storage, and water surface elevation. If additional water transfer programs draw reservoirs down or reduce river flows below the acceptable criteria for water quality management, the effects could be cumulatively significant. To prevent cumulatively significant impacts, water agencies would have to cooperatively set release limits on reservoirs such that the reservoirs would not be drawn down below the levels required to maintain suitable water quality levels within the reservoirs, especially during the summer season when water levels are already low within the reservoirs.

9.3.1.4 ECOSYSTEM RESTORATION AND WATER QUALITY IMPROVEMENT PROJECTS

In the last few years, the abundance indices calculated by the IEP demonstrated significant declines in numerous pelagic fishes in the upper San Francisco Bay-Delta Estuary. A study plan was developed and intensive data analysis and technical studies have begun into the causes of the decline. The current conceptual model for why fish abundance has declined abruptly in recent years assumes at least three general factors that may be acting individually or in combination to lower pelagic productivity: (1) toxins; (2) invasive species; and (3) water project operations. Although studies are underway, the ability to understand the implications of various hypothesized causes of decline is most likely at least a year away (see Section 10.1.4.1). The outcome of these findings, when available, most likely will necessitate a different suite of long-term CVP/SWP operations or alternate actions not yet identified.

Additionally, the RWQCB released the draft staff report for the Delta Mercury TMDL in August of 2005. The RWQCB subsequently released TMDL language in the form of draft basin plan amendments to the Sacramento River and San Joaquin River Basin Plan during the summer of 2006. In the "*Control of Methylmercury in the Delta Draft Basin Plan Amendment Staff Report*" (RWQCB 2006), it states that the 20-year average total mercury loads from the American River, Putah Creek, and the Feather River should be reduced by 32 kg/yr from current levels. It is anticipated by the SWRCB that future TMDL programs fro these watersheds will implement this reduction. In January 2006, the SWRCB conducted a workshop regarding salinity objectives for the southern Delta. It is anticipated by the SWRCB that this workshop would serve as a starting point for the SWRCB to develop and manage comprehensive study plans to address salinity issues in the southern Delta. The SWRCB expects that the studies conducted could potentially result in amendments to current regulatory basin plans. It is anticipated by the SWRCB that this process may require up to two years to complete. These efforts and pending D-164 salinity objectives will provide additional regulatory compliance standards to assist in balancing the multiple resource demands on the system in the future.

Additionally, several water quality improvement projects designed to improve water quality for consumption are included in the cumulative condition. Many of these projects focus on Delta water quality conditions, and are designed to improve reliability and the quality of source water supplies and deliveries, either through infrastructure modification or changes to the location and timing of diversions. The effects of these projects, along with projects designed to improve water quality for habitat-based reasons, in combination with implementation of the Yuba Accord Alternative would not be cumulatively significant.

9.3.1.5 LOCAL PROJECTS IN THE YUBA REGION

Of the projects identified above, the Yuba River Development Project FERC Relicensing has the potential to affect water quality conditions in the Yuba Region. Prior to the expiration of the Yuba Project FERC license (FERC No. 2246) in 2016, YCWA must undergo a relicensing process that allows FERC, state and federal resource agencies (CDFG, SWRCB, USFWS, NMFS, etc.), conservation groups, and the general public to reconsider appropriate operations and land management for the project in consideration of current social and scientific knowledge. In the relicensing process, FERC will be obligated to prepare an EA or EIS, which will assess the environmental consequences of the proposed future operation of the Yuba Project and compare the potential impacts of proposed alternatives. Along with the EA or EIS, proposed license terms and conditions, and PM&Es will be considered. FERC likely will issue a Final EA or EIS and a decision on the license renewal, which is anticipated to include terms and conditions for operating the hydropower project. However, it is not anticipated that regulatory requirements resulting from the FERC relicensing process would contribute to potentially significant cumulative adverse impacts.

9.3.1.6 OTHER CUMULATIVE SURFACE WATER QUALITY IMPACT CONSIDERATIONS

The quantitative operations-related impact considerations for the Yuba Accord Alternative, relative to the Existing Condition, are discussed in Section 9.2.5. Potential impacts identified in Section 9.2.5 provide an indication of the potential incremental contributions of the Yuba Accord Alternative to cumulative impacts. These potential impacts are summarized here:

- ❑ Impact 9.2.5-1: Decreases in New Bullards Bar Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant

- Impact 9.2.5-2: Changes in monthly mean flows in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant
- Impact 9.2.5-3: Changes in monthly mean water temperatures in the lower Yuba River that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant
- Impact 9.2.5-4: Decreases in Oroville Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant
- Impact 9.2.5-5: Changes in monthly mean flows in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant
- Impact 9.2.5-6: Changes in monthly mean water temperatures in the Feather River that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant
- Impact 9.2.5-7: Changes in monthly mean flows in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses– Less than Significant
- Impact 9.2.5-8: Changes in monthly mean water temperatures in the Sacramento River that could result in degraded water quality conditions or adverse effects to designated beneficial uses– Less than Significant
- Impact 9.2.5-9: Changes to the monthly mean location of X2 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant
- Impact 9.2.5-10: Changes to monthly mean Delta outflow that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant
- Impact 9.2.5-11: Changes to monthly mean E/I ratios that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant
- Impact 9.2.5-12: Salinity changes in the Sacramento River at Emmaton that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant
- Impact 9.2.5-13: Salinity changes in the San Joaquin River at Jersey Point that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant
- Impact 9.2.5-14: Salinity changes in the San Joaquin River at Airport Way Bridge (Vernalis) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant
- Impact 9.2.5-15: Salinity changes in the San Joaquin River at Brandt Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant

- Impact 9.2.5-16: Salinity changes in Middle River near Old River that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- Impact 9.2.5-17: Salinity changes in Old River at Tracy Road Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- Impact 9.2.5-18: Salinity changes in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- Impact 9.2.5-19: Salinity changes at CCWD Pumping Plant #1 that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- Impact 9.2.5-20: Salinity changes in the West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses - Less than Significant
- Impact 9.2.5-21: Salinity changes in the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses - Less than Significant
- Impact 9.2.5-22: Salinity changes at Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- Impact 9.2.5-23: Salinity changes at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- Impact 9.2.5-24: Changes in chloride concentrations in Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- Impact 9.2.5-25: Changes in chloride concentrations in CCWD Pumping Plant #1 (Rock Slough) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- Impact 9.2.5-26: Changes in chloride concentrations in Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- Impact 9.2.5-27: Changes in chloride concentrations in West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- Impact 9.2.5-28: Changes in chloride concentrations in Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant

- ❑ Impact 9.2.5-29: Changes in chloride concentrations in Middle River at Victoria Canal that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta - Less than Significant
- ❑ Impact 9.2.5-30: Changes in chloride concentrations at the Stockton Intake that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant
- ❑ Impact 9.2.5-31: Changes in DOC concentrations at Old River at Highway 4 (CCWD Los Vaqueros Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant
- ❑ Impact 9.2.5-32: Changes in DOC concentrations at Old River at Rock Slough (CCWD Intake) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant
- ❑ Impact 9.2.5-33: Changes in DOC concentrations at West Canal at the mouth of Clifton Court Forebay (SWP Banks Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses in the Delta – Less than Significant
- ❑ Impact 9.2.5-34: Changes in DOC concentrations at the Delta-Mendota Canal at the Jones Pumping Plant (CVP Jones Pumping Plant) that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant
- ❑ Impact 9.2.5-35: Changes in monthly mean flows in Old River at Bacon Island that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant
- ❑ Impact 9.2.5-36: Changes in monthly mean flows in the Middle River at Middle River that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant
- ❑ Impact 9.2.5-37: Changes in monthly mean flows in the Middle River at Mowry Bridge that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant
- ❑ Impact 9.2.5-38: Decreases in San Luis Reservoir storage that could result in degraded water quality conditions or adverse effects to designated beneficial uses – Less than Significant

Although these impacts would be less than significant, the potential nevertheless exists for cumulative impacts. Cumulative impact determinations are presented nevertheless below, and are based upon consideration of the quantified Yuba Accord Alternative impacts relative to the Existing Condition, in combination with the potential impacts of other reasonably foreseeable projects. These cumulative impact determinations are summarized by region.

9.3.1.7 POTENTIAL FOR CUMULATIVE WATER QUALITY IMPACTS WITHIN THE PROJECT STUDY AREA

Results from the quantitative analysis generally indicate that direct project-related impacts to water quality would be less than significant. Nevertheless, the Yuba Accord Alternative still could incrementally contribute to cumulative water quality impacts within the project study area. The frequency and magnitude of the quantitative hydrologic changes associated with the Yuba Accord Alternative and the other qualitative analytical considerations discussed above both were considered during the development of the overall cumulative impact conclusions discussed below for the Yuba Accord Alternative Cumulative Condition, relative to the Existing Condition.

Impact 9.3.1.7-1 Potential for significant cumulative water quality impacts within the Yuba Region

Of the projects discussed above, the Yuba River Development Project FERC Relicensing has the potential to affect future water quality conditions in the Yuba Region. However, because FERC will consider such water quality impacts during the re-licensing process and impose conditions to mitigate them, significant cumulative impacts on water quality in the Yuba Region are not expected to occur as a result of implementing the Yuba Accord Alternative in combination with other reasonably foreseeable future local projects in the Yuba Region. In addition, reasonably foreseeable future projects outside of the Yuba Region (i.e., CVP/SWP Upstream of the Delta Region, Delta Region, and Export Service Area) are not expected to result in operational changes of the Yuba Project, or have any other effects in the Yuba Region. The overall effects on water quality in the Yuba Region therefore would be minor, and the impacts of the Yuba Accord Alternative Cumulative Condition, compared to the Existing Condition, on water quality within the Yuba Region would be less than significant.

Impact 9.3.1.7-2 Potential for significant cumulative water quality impacts within the CVP/SWP Upstream of the Delta Region

In consideration of the aforementioned qualitative and quantitative cumulative analyses, significant cumulative impacts on water quality in the CVP/SWP Upstream of the Delta Region could occur as a result of implementing the Yuba Accord Alternative in combination with other reasonably foreseeable future.

Future levels of demand for water in California will be addressed through the implementation of numerous projects, including the previously identified general categories of: water storage and conveyance projects; projects related to CVP/SWP system operations; and water transfer and acquisition programs. Presently, it is uncertain how the implementation of the various projects within these general categories will change the timing, magnitude and frequency of flows and water temperatures in the CVP/SWP Upstream of the Delta Region. A number of these projects would be expected to result in increased water availability and therefore increased CVP/SWP operational flexibility to meet various instream beneficial uses. By contrast, some of these projects could be expected to result in decreased operational and management flexibility due to the primary purposes of increased diversions, water supplies and conveyance.

It can be reasonably assumed that each of these projects will be designed to avoid or minimize the adverse impacts to water quality associated with its implementation, and therefore individually will result in less than significant impacts. It can also be reasonably assumed, however, that the combination of a number of less than significant impacts from these projects could result in cumulative potentially significant impacts. Therefore, it is concluded that implementation of the Yuba Accord Alternative in combination with other reasonably foreseeable projects could result in potentially significant and unavoidable cumulative impacts to water quality in the CVP/SWP Upstream of the Delta Region.

Impact 9.3.1.7-3 Potential for significant cumulative water quality impacts within the Delta Region

In consideration of the aforementioned qualitative and quantitative cumulative analyses, significant cumulative impacts on Delta water quality could occur as a result of implementing the Yuba Accord Alternative in combination with other reasonably foreseeable future projects.

It is uncertain how the implementation of the various reasonably foreseeable projects listed above would change evaluated Delta water quality parameters. A number of these projects would be expected to result in increased water availability and, therefore, increased CVP/SWP operational flexibility to meet Delta water quality objectives and various instream beneficial uses. In addition, implementation of ecosystem restoration and fisheries improvement projects could result in improved water quality conditions (e.g., reduced sediment loading), although the overall effectiveness of these projects, particularly in consideration of potential future hydrologic changes, is uncertain.

By contrast, some of the previously listed reasonably foreseeable projects are expected to result in decreased operational and management flexibility due to the primary purposes of increased diversions and water supplies associated with future levels of demand, which could result in reduced Delta inflows and increased exports (potentially affecting salinity and south Delta water levels).

It can be assumed that each of the above listed reasonably foreseeable projects will be deigned to avoid or minimize adverse impacts to Delta water quality that may be associated with its implementation, and therefore individually will result in less than significant impacts. It can also be assumed, however, that the combination of a number of less than significant impacts for these projects could result in cumulative potentially significant impacts. Therefore, it is concluded that implementation of the Yuba Accord Alternative in combination with other reasonably foreseeable projects could result in potentially significant and unavoidable cumulative impacts to water quality in the Delta Region.

Impact 9.3.1.7-4 Potential for significant cumulative water quality impacts within the Export Service Area

As discussed above in Sections 9.2.5 and 9.2.8, reservoir operations would result in less than significant impacts to water quality in San Luis Reservoir. Water surface elevation fluctuations and changes in storage resulting from San Luis Reservoir operations to meet increased future demands would not be expected to substantially differ from existing operations. San Luis Reservoir currently is a regulating facility for south-of-Delta deliveries and is expected to continue as such in the future with similar operational constraints, such as San Luis Reservoir low point control. Future San Luis Reservoir operations are expected to cause fluctuations (increases and decreases) in water surface elevations, as well as changes in storage, that are within the range of historical variations and, thus, these changes will remain within the range of seasonal drawdown levels observed under the Existing Condition. Because reservoir operations will not increase beyond the range of current reservoir operations, it is anticipated that the new projects discussed above would not adversely impact water quality in San Luis Reservoir. Therefore, the overall effects on water quality associated with San Luis Reservoir would be minor, and the potential cumulative impacts of the Yuba Accord Alternative Cumulative Condition, relative to the Existing Condition, would be less than significant.

9.3.2 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE MODIFIED FLOW ALTERNATIVE CUMULATIVE CONDITION COMPARED TO THE EXISTING CONDITION

It is anticipated that the Modified Flow Alternative Cumulative Condition will have the same potential for cumulative impacts as the Yuba Accord Alternative Cumulative Condition. Therefore, the description of the potential impacts in Section 9.3.1 also serves as the description of cumulative impacts associated with the Modified Flow Alternative. Thus, the Modified Flow Alternative Cumulative Condition would result in the following potential cumulative impacts:

- Yuba Region – Potential cumulative impacts on water quality in the Yuba Region would be less than significant.
- CVP/SWP Upstream of the Delta Region – Potential cumulative impacts on water quality in the CVP/SWP Upstream of the Delta Region could be potentially significant and unavoidable.
- Delta Region – Potential cumulative impacts on water quality in the Delta Region could be potentially significant and unavoidable.
- Export Service Area – Potential cumulative impacts on water quality in the Export Service Area (San Luis Reservoir) could be less than significant.

9.4 POTENTIAL CONDITIONS TO SUPPORT APPROVAL OF YCWA'S WATER RIGHTS PETITION

Other than the measures identified below in Section 9.5, which would be incorporated into the project to protect Delta water quality, no unreasonable adverse effects to water quality would occur under the Proposed Project/Action or an action alternative and, thus, no other impact avoidance measures or protective conditions are identified for the SWRCB's consideration in determining whether or not to approve YCWA's petitions to implement the Yuba Accord.

9.5 MITIGATION MEASURES/ENVIRONMENTAL COMMITMENTS

Pursuant to the provisions originally identified for the EWA Program (Reclamation *et al.* 2003), the following protective measures have been incorporated into the project to continue with standard operating procedures and to improve the water quality to users in and south of the Delta.

- Mitigation Measure 9-1: Carriage water will be used to maintain salinity and chloride concentrations in the Delta.
- Mitigation Measure 9-2: YCWA operational flexibility will be utilized to ensure that refilling of the reservoir will not adversely affect water quality in the Delta and export service areas south of the Delta.

9.5.1 CARRIAGE WATER

Carriage water[71] is an increase in Delta outflow that protects Delta water quality and maintains chloride concentrations during CVP/SWP export operations at levels that would be equivalent to those that would occur in the absence of such export operations. Carriage water is currently used to increase Delta outflow and to maintain water quality to users in and south of the Delta during CVP/SWP export operations.

DWR and Reclamation historically charged entities a flat 20 percent carriage water charge for water purchased upstream from the Delta and conveyed through the CVP/SWP pumps to the south of Delta SWP/CVP water users during the summer months. For example, if an entity, like EWA, wanted to pump 80 AF, the entity would have to buy 100 AF. The 100 AF would be provided as inflow to the Delta and 20 AF of the transfer would be used to increase Delta outflow to ensure that chloride concentrations would not increase due to the 80 AF of increased pumping. In the last few years, Reclamation and DWR have developed a way to use DSM2 on a real time basis to estimate the amount of carriage water needed in that year to pump EWA water (or any other water supply including SWP water users, the CVP, and other entities purchasing water upstream of the Delta) without causing an increase in EC or chloride concentration in the Delta. Reclamation's and DWR's work over the past few years indicates that the carriage water percentage required to maintain Delta water quality can range from 0 to 25 percent, or more. Given these newly developed techniques, the EWA can purchase water upstream from the Delta, but for every acre-foot purchased, 0 to 25 percent or more of that acre-foot must be dedicated to increase Delta outflow. The remainder may be pumped at the CVP/SWP pumping plants without causing any increase in chloride concentrations within the Delta due to the EWA Program. During past EWA water transfers involving changes in the timing of CVP/SWP exports, carriage water has provided the mechanism necessary to maintain water quality in the Delta. Because surface water and groundwater available for transfer from the Proposed Yuba Accord would be provided to Reclamation and DWR for the EWA Program, it is assumed that similar carriage water provisions would apply.

9.5.2 NEW BULLARDS BAR RESERVOIR REFILL

Refill conditions in New Bullards Bar Reservoir generally occur during February and March. During this time, YCWA has the operational flexibility to ensure that refilling of the reservoir will not adversely affect water quality in a manner that could potentially impact beneficial uses in the Delta and export service areas south of the Delta. The refilling of New Bullards Bar Reservoir would be based on conditions beginning in January of the current water year. If it is

[71] Increases in Delta chloride concentrations due to increases in CVP and SWP pumping from the south Delta can occur when the total pumping is greater than the flows into the central and south Delta, minus the in-Delta agricultural uses in the central and south Delta. Flows into the central and south Delta include flows from the Sacramento River into the central Delta through the CVP Delta Cross Channel facility and Georgiana Slough; flows from eastside streams such as the Mokelumne, Cosumnes, and Calaveras rivers; and flows from the San Joaquin River. When the total CVP and SWP pumping exceeds the total inflow to the central and south Delta, minus agriculture uses in the central and south Delta, the difference must come from the Sacramento River via three Mile Slough or around the western end of Sherman Island. When CVP and SWP pumping exceeds the total of inflow to the central and south Delta less agriculture uses in the central and south Delta, ocean salts move upstream in the lower San Joaquin River resulting in an increase in salinity in the central and south Delta and at the CVP and SWP pumping plants. Thus, increased pumping in summer months to pump EWA pay-back water thought the Delta has the potential to cause increased chloride concentrations in the Delta. However, carriage water, which is an increase in Delta outflow used to maintain chloride concentrations at pre-increased CVP/SWP levels, allows the maintenance of chloride concentrations during increased pumping in the summer months, as described above.

anticipated that reductions in lower Yuba River flow during the refill period would impact water quality conditions in the Delta, then YCWA would apply a water accounting procedure to determine the volume of water that would have been stored in the reservoir during the winter refill period. The amount of water foregone will be accounted for and repaid by YCWA via the refill accounting mechanisms described in Appendix E2, Exhibit 5.

9.6 POTENTIALLY SIGNIFICANT UNAVOIDABLE IMPACTS

There are no potentially significant unavoidable project-related impacts to water quality associated with the implementation of the Proposed Project/Action or an action alternative, individually. However, the Yuba Accord Alternative, in combination with other reasonably foreseeable future projects, could result in potentially significant unavoidable cumulative impacts water quality in the CVP/SWP Upstream of the Delta Region and the Delta Region due to the combined effects of multiple projects on flows in the Feather and Sacramento Rivers, and Delta inflow. Similarly, the Modified Flow Alternative, in combination with other reasonably foreseeable future projects, could result in potentially significant unavoidable cumulative impacts on water quality in the CVP/SWP Upstream of the Delta Region and the Delta Region.

CHAPTER 10
FISHERIES AND AQUATIC RESOURCES

10.1 ENVIRONMENTAL SETTING/AFFECTED ENVIRONMENT

This section describes the environmental setting/affected environment related to fisheries and aquatic ecosystems in water bodies that may be influenced by implementation of the Proposed Lower Yuba River Accord. The following sections describe the aquatic habitats and fish populations within the Yuba Region, CVP/SWP Upstream of the Delta Region, the Delta Region, and the Export Service Area (see below), utilizing available information, particularly from the EWA EIS/EIR (Reclamation *et al.* 2004).

10.1.1 FISHERIES RESOURCES IN THE PROJECT STUDY AREA

Within the project study area, the Yuba Region, CVP/SWP Upstream of the Delta Region and the Delta Region include the Yuba, Feather, and Sacramento rivers, Oroville and New Bullards Bar reservoirs, and the Delta. For fisheries purposes, the Export Service Area includes San Luis Reservoir. Sections 10.1.1.2 through 10.1.1.5 describe specific conditions (e.g., species composition, distribution, time of year when the species are present) for each of the major water bodies that are evaluated in the Yuba Region, CVP/SWP Upstream of the Delta Region, the Delta Region, and the Export Service Area. Life histories and life stage-specific environmental considerations for several species may differ slightly among the water bodies. Any differences are noted in the discussions of the individual water bodies. If there are not any noted differences, the species life history and general environmental considerations are assumed to be identical to the general discussions in Section 10.1.1.1, Overview of Fish Species.

10.1.1.1 OVERVIEW OF FISH SPECIES

Special-status fish species considered in this section are those that are state or federally listed as threatened or endangered, proposed for state or federal listing as threatened or endangered, species classified as candidates for future state or federal listing, and state species of special concern. Special-status fish species potentially occurring in the regional study area were identified using USFWS species lists based on individual USGS topographic quadrangles in which the overall project study area is located, and through review of environmental documents for other projects in the region. **Table 10-1** presents the special-status fish species that could occur within the regional study area, their regulatory status, and the water body where each species is anticipated to occur.

Species of primary management concern evaluated in this analysis include those that are recreationally or commercially important (fall-run Chinook salmon (*Oncorhynchus tshawytscha),* steelhead (*Oncorhynchus mykiss*), American shad (*Alosa sapidissima*), and striped bass (*Morone saxatilis*), federal- and/or state-listed species and species proposed for federal or state listing within the area (winter- and spring-run Chinook salmon, steelhead, delta smelt (*Hypomesus transpacificus*) and green sturgeon (*Acipenser medirostris*), and State species of special concern (late fall-run Chinook salmon[1], green sturgeon, hardhead (*Mylopharodon conocephalus*), longfin

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[1] NMFS recognizes the late-fall-run Chinook salmon in the Central Valley fall-run ESU (Moyle 2002). On April 15, 2004, NMFS published a notice in the Federal Register acknowledging establishment of a species of concern list, addition of species to the species of concern list, description of factors for identifying species of concern, and revision of the candidate species list. In this notice, NMFS announced the Central Valley Fall-run and Late Fall-

smelt (*Spirinchus thaleichthys*), river lamprey (*Lamptera ayresi*), Sacramento perch (*Archoplites interruptus)*, Sacramento splittail (*Pogonichthys macrolepidotus*), and San Joaquin roach (*Lavinia symmetricus ssp.*).

Table 10-1. Special-Status Fish Species within the Yuba Region, CVP/SWP Upstream of the Delta Region and the Delta Regional Study Areas

Common Name	Scientific Name	Status (see below)	Location
Central Valley fall-/late fall-run Chinook salmon	*Oncorhynchus tshawytscha*	CSC	Sacramento, Feather and Yuba rivers, and the Delta
Central Valley spring-run Chinook salmon	*Oncorhynchus tshawytscha*	T, ST	Sacramento, Feather and Yuba rivers, and the Delta
Central Valley winter-run Chinook salmon	*Oncorhynchus tshawytscha*	E, SE	Sacramento River and the Delta
Central Valley steelhead	*Oncorhynchus mykiss*	T	Sacramento, Feather and Yuba rivers, and the Delta
Delta smelt	*Hypomesus transpacificus*	T, ST	Delta
Southern Distinct Population Segment of North American green sturgeon	*Acipenser medirostris*	T, CSC	Sacramento, Feather and Yuba rivers, and the Delta
Hardhead	*Mylopharodon conocephalus*	CSC	Sacramento, Feather and Yuba rivers.
Longfin smelt	*Spirinchus thaleichthys*	CSC	Delta
River lamprey	*Lampetra ayresi*	CSC	Sacramento, Feather and Yuba rivers, and the Delta
Sacramento perch	*Archoplites interruptus*	CSC	Sacramento River and the Delta
Sacramento splittail	*Pogonichthys macrolepidotus*	CSC	Sacramento and Feather rivers, and the Delta
San Joaquin roach	*Lavinia symmetricus ssp*	CSC	Sacramento River

Status Key:

E = Endangered	Officially listed (in the Federal Register) as being endangered.
T = Threatened	Federally listed as likely to become endangered within the foreseeable future.
P = Proposed	Officially proposed (in the Federal Register) for listing as endangered or threatened.
C = Candidate	Candidate to become a proposed species.
SE = State Endangered	State listed as endangered.
ST = State Threatened	State listed as likely to become endangered.
CSC = State Species of Special Concern	Species of special concern to the CDFG.

Special emphasis is placed on these species of primary management concern to facilitate compliance with applicable laws, particularly the state and federal ESA's, and to be consistent with state and federal restoration/recovery plans and NMFS and USFWS BOs. This focus is consistent with: (1) CALFED's 2000 ERPP and Multi-Species Conservation Strategy (MSCS); (2) the programmatic determinations for the CALFED program, which include CDFG's Natural Community Conservation Planning Act (NCCPA) approval and the programmatic BOs issued by NMFS and USFWS; (3) USFWS's 1997 Draft Anadromous Fish Restoration Program (AFRP), which identifies specific actions to protect anadromous salmonids; (4) CDFG's 1996 Steelhead Restoration and Management Plan for California, which identifies specific actions to protect

run Chinook Salmon ESU change in status from a candidate species to a species of concern. In 1999, the Central Valley ESU underwent a status review after NMFS received a petition for listing. Pursuant to that review, NMFS found that the species did not warrant listing as threatened or endangered under the ESA, but sufficient concerns remained to justify addition to the candidate species list. Therefore, according to NMFS' April 15, 2004 interpretation of the ESA provisions, the Central Valley ESU now qualifies as a species of concern, rather than a candidate species (69 FR 19977).

steelhead; and (5) CDFG's Restoring Central Valley Streams, A Plan for Action (1993), which identifies specific actions to protect salmonids. Improvement of habitat conditions for these species of primary management concern could protect or enhance conditions for other fish resources, including native resident species.

Evaluating potential impacts on fishery resources within the Yuba Region, CVP/SWP upstream of the Delta Region, and the Delta Region study areas requires an understanding of fish species' life histories and life stage-specific environmental requirements. General information is provided below regarding life histories of fish species of primary management concern occurring within the study area. Time periods associated with individual species life stages are derived from a combination of literature review and analyses of survey data.

CHINOOK SALMON

Chinook salmon is the most important commercial species of anadromous fish in California. Chinook salmon have evolved a broad array of life history patterns that allow them to take advantage of diverse riverine conditions throughout the year. Four principal life history variants are recognized and are named for the timing of their spawning runs: fall-run, late fall-run, winter-run and spring-run. The Sacramento River supports all four runs of Chinook salmon. The larger tributaries to the Sacramento River (American, Yuba, and Feather rivers) and rivers in the San Joaquin Basin also provide habitat for one or more of these runs. A separate discussion of each of these four runs is provided below. **Table 10-2** illustrates the general differences among the timing of life stages of the four Central Valley Chinook salmon runs. Slight differences in timing may occur depending on the river, and are discussed in the following narratives.

Table 10-2. Generalized Life History Timing of Central Valley Chinook Salmon Runs

Run	Adult Migration Period	Peak Migration Period	Spawning Period [a]	Peak Spawning Period	Fry Emergence Period	Juvenile Stream Residency	Juvenile Emigration Period
Late fall	Oct – Apr	Dec	Early Jan - Mar	Feb - Mar	Apr - Jun	7-13 months	Apr - Dec
Winter	Dec - Jul	Mar	Late Apr - Oct	May - Jun	Jul - Oct	5-10 months	Jul - Apr
Spring	Mid-Feb -Jul	Apr - May	Late Aug - Dec	Mid-Sep	Nov - Mar	3-15 months	Oct - Mar
Fall	Jul - Dec	Sep - Oct	Late Sep - Mar	Oct - Nov	Dec - Mar	1-7 months	Dec - Jun

Sources: (CDFG 1998; Moyle 2002; NMFS 2004; Vogel and Marine 1991).
[a] The time periods identified for spawning include the time required for incubation and initial rearing, before emergence of fry from spawning gravels.

Winter-run Chinook Salmon

Of all water bodies that may be influenced by implementation of the Proposed Lower Yuba River Accord, winter-run Chinook salmon occur only in the Sacramento River; therefore, this species account is specific to the Sacramento River. The Sacramento River winter-run Chinook salmon ESU is listed as "endangered" under both the federal and state ESA. In 1993, critical habitat for winter-run Chinook salmon was designated to include the Sacramento River from Keswick Dam, (RM 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta. Also included are waters west of the Carquinez Bridge, Suisun Bay, San Pablo Bay, and San Francisco Bay north of the San Francisco/Oakland Bay Bridge (NMFS 1993).

Adult winter-run Chinook salmon immigration and holding (upstream spawning migration) through the Delta and into the lower Sacramento River occurs from December through July, with a peak during the period extending from January through April (USFWS 1995a). Winter-run Chinook salmon primarily spawn in the main-stem Sacramento River between Keswick Dam (RM 302) and Red Bluff Diversion Dam (RM 243). Winter-run Chinook salmon spawn between late-April and mid-August, with a peak generally in June. Winter-run Chinook salmon embryo incubation in the Sacramento River can extend into October (Vogel and Marine 1991).

Winter-run Chinook salmon fry rearing in the upper Sacramento River exhibit peak abundance during September, with fry and juvenile emigration past Red Bluff Diversion Dam occurring from July through March (Reclamation 1992; Vogel and Marine 1991), although NMFS (NMFS 1993; NMFS 1997) report juvenile rearing and outmigration extending from June through April. Emigration (downstream migration) of winter-run Chinook salmon juveniles past Knights Landing, approximately 155.5 river miles downstream of the Red Bluff Diversion Dam, reportedly occurs between November and March, peaking in December, with some emigration continuing through May in some years (Snider and Titus 2000a; Snider and Titus 2000b). The numbers of juvenile winter-run Chinook salmon caught in rotary screw traps at the Knights Landing sampling location were reportedly dependent on the magnitude of flows during the emigration period (Snider and Titus 2000a; Snider and Titus 2000b). Additional information on the life history and habitat requirements of winter-run Chinook salmon is contained in the NMFS BO for this run, which was developed to specifically evaluate impacts on winter-run Chinook salmon associated with CVP and SWP operations (NMFS 1993).

Spring-run Chinook Salmon

Historically, spring-run Chinook salmon occurred in the headwaters of all major river systems in the Central Valley where natural barriers to migration were absent. Beginning in the 1880s, harvest, water development, construction of dams that prevented access to headwater areas and habitat degradation significantly reduced the number and range of spring-run Chinook salmon in the Central Valley. Today, Mill, Deer, and Butte creeks in the Sacramento River system support self-sustaining, persistent populations of spring-run Chinook salmon. The upper Sacramento, Yuba, and Feather rivers also are reported to support spring-run Chinook salmon. However, documentation of these populations is weak, and these populations may be hybridized to some degree with fall-run Chinook salmon. Due to the significantly reduced range and small size of remaining spring-run populations, the Central Valley spring-run Chinook salmon ESU is listed as a "threatened" species under both the state CESA and federal ESA.

The Central Valley Spring-run Chinook salmon ESU has been reduced to only three naturally spawning independent populations that are free of hatchery influence: Deer Creek, Mill Creek and Butte Creek (70 FR 37160 (June 28, 2005)). There are other natural populations (i.e., in Clear, Antelope, Big Chico and Beegum creeks) of spring-run Chinook salmon, but the Central Valley Technical Recovery Team considers them to be dependant upon the populations in Deer, Mill and Butte creeks (70 FR 37160 (June 28, 2005)). The naturally spawning populations of spring-run Chinook salmon in the Feather and Yuba rivers are also considered to be part of this ESU, as is the spring-run Chinook salmon hatchery stock from the Feather River Hatchery. Recent results by Banks et al. (Banks *et al.* 2000) suggest the spring-run phenotype in the Central Valley is actually shown by two genetically distinct subpopulations, Butte Creek spring-run and Deer and Mill creeks spring-run.

Spring-run Chinook salmon acquired and maintained genetic integrity through spatial-temporal isolation from other Central Valley Chinook salmon runs. Historically, spring-run

Chinook salmon were temporally isolated from winter-run, and largely isolated in both time and space from the fall-run. Much of this historical spatial-temporal integrity has broken down, resulting in intermixed life history traits in many remaining habitats.

Sacramento River spring-run Chinook salmon are known to use the Sacramento River as a migratory corridor to spawning areas in upstream tributaries. Historically, spring-run Chinook salmon did not utilize the mainstem Sacramento River downstream of the Shasta Dam site except as a migratory corridor to and from headwater streams (CDFG 1998). Currently, the extent of spring-run Chinook salmon utilization of the upper Sacramento River (i.e., upstream of the Red Bluff Diversion Dam and downstream of Keswick Dam) for other than a migratory corridor is unclear.

All of the potential spring-run Chinook salmon holding and spawning habitat in the mainstem Sacramento River is located upstream from the Red Bluff Diversion Dam and downstream of Keswick Dam (CDFG 1998). The physical environment downstream from Keswick Dam is adequate for spring-run Chinook salmon; however, in some years high water temperatures would prevent egg and embryo survival (USFWS 1990 as reported *in* CDFG 1998). Water temperature downstream from Keswick Dam is a function of flow releases from Shasta Reservoir, the condition of reservoir storage, depth of water released from the reservoir, and climate. In years of low storage in Shasta Reservoir and under low flow releases, water temperatures exceed 56°F downstream of Keswick Dam during critical months for spring-run Chinook salmon spawning and egg incubation[2].

Several sources suggest that putative spawning by spring-run Chinook salmon in the mainstem Sacramento River may actually be by spring-run/fall-run hybrids or early fall-run. For example, NMFS, in the OCAP BO (2004), reports that due to the overlap of ESUs and resultant hybridization since the construction of Shasta Dam, Chinook salmon that spawn in the mainstem Sacramento River during September are more likely to be early fall-run rather than spring-run. In the CVP and SWP OCAP BA (2004), it is reported that the increasing overlap in spring-run and fall-run spawning periods is evidence that introgression is occurring. CDFG (1998) states:

> "*Streams that continue to support wild, persistent, and long-term documented populations of spring-run Chinook salmon are Mill, Deer and Butte creeks. These remaining wild populations of Sacramento River spring-run Chinook salmon are small, isolated, and their range is restricted. There are other streams which may support Sacramento spring-run Chinook salmon but documentation is weak (Battle Creek), their populations are not persistent (Antelope, Cottonwood, and Big Chico creeks), populations may be hybridized to some degree with fall-run due to lack of spatial separation of spawning habitat (Sacramento, Yuba and Feather rivers), or is a hybrid hatchery population (Feather River Hatchery).*"

CDFG (1998) estimated run sizes for different tributaries of the Sacramento River in their status review of spring-run Chinook salmon in the Sacramento River Drainage. Run size estimates were made for Battle, Antelope, Mill, Deer, Big Chico, and Butte Creeks. In addition, a run size estimate was made for the Sacramento River by counting fish displaying spring-run characteristics (i.e., passing through the fishway at the Red Bluff Diversion Dam between mid-March and mid-September). During the 1994 to 1997 time period, the portion of putative spring-run Chinook salmon migrating upstream of the Red Bluff Diversion Dam, and not

[2] A water temperature of 56°F represents the upper value of the water temperature range (i.e., 41.0ºF to 56.0°F) suggested for maximum survival of eggs and yolk-sac larvae in the Central Valley of California (USFWS 1995c).

accounted for in Battle Creek estimates, accounted for approximately two percent of the estimated spring-run Chinook salmon population (excluding the Feather River).

Adult spring-run Chinook salmon immigration and holding in California's Central Valley Basin occurs from mid-February through September (CDFG 1998; Lindley *et al.* 2004). Suitable water temperatures for adult upstream migration reportedly range between 57ºF and 67ºF (NMFS 1997). In addition to suitable water temperatures, adequate flows are required to provide migrating adults with olfactory and other cues needed to locate their spawning reaches (CDFG 1998).

The primary characteristic distinguishing spring-run Chinook salmon from the other runs of Chinook salmon is that adult spring-run Chinook salmon hold in areas downstream of spawning grounds during the summer months until their eggs fully develop and become ready for spawning. NMFS (1997) states, "*Generally, the maximum temperature for adults holding, while eggs are maturing, is about 59- 60°F, but adults holding at 55-56°F have substantially better egg viability.*" Spring-run Chinook salmon reportedly spawn in the lower Yuba River, the lower Feather River and, to some extent, the mainstem Sacramento River. Spawning and embryo incubation has been reported to primarily occur during September through mid-February, with spawning peaking in mid-September (DWR 2004c; DWR 2004d; Moyle 2002; Vogel and Marine 1991). Some portion of an annual year-class may emigrate as post-emergent fry (individuals less than 45 mm in length), and some rear in the upper Sacramento river and tributaries during the winter and spring and emigrate as juveniles (individuals greater than 45 mm in length, but not having undergone smoltification) or smolts (silvery colored fingerlings having undergone the smoltification process in preparation for ocean entry). The timing of juvenile emigration from the spawning and rearing grounds varies among the tributaries of origin, and can occur during the period extending from October through April (Vogel and Marine 1991). In the Feather River, data on juvenile spring-run emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run emigration (DWR and Reclamation 1999; Painter *et al.* 1977). In Butte Creek, the bulk of emigration is reported to occur between January and March, with some emigration continuing through April (Lindley *et al.* 2004). Some juveniles continue to rear in Butte Creek through the summer and emigrate as yearlings from October to February, with peak yearling emigration occurring in November and December (CDFG 1998).

Fall-run Chinook Salmon

In the Central Valley, fall-run Chinook salmon are the most numerous of the four salmon runs, and continue to support commercial and recreational fisheries of significant economic importance. Fall-run Chinook salmon is currently the largest run of Chinook salmon utilizing the Sacramento River system. The Feather and Yuba rivers and San Joaquin River tributaries also support runs of fall-run Chinook salmon.

Adult fall-run Chinook salmon generally begin migrating upstream annually in July, with immigration continuing through December in most years (NMFS 2004; Vogel and Marine 1991). It has been reported that fall-run Chinook salmon in the Central Valley immigrate into natal rivers as early as June (Moyle 2002). Adult fall-run Chinook salmon immigration generally peaks in November, and typically greater than 90 percent of the run has entered the river by the end of November (CDFG 1992; CDFG 1995).

The timing of adult Chinook salmon spawning activity is strongly influenced by water temperatures. When daily average water temperatures decrease to approximately 60°F, female

Chinook salmon begin to construct nests (redds) into which their eggs (simultaneously fertilized by males) are eventually released. Fertilized eggs are subsequently buried with streambed gravel. Due to the timing of adult arrivals and occurrence of appropriate spawning temperatures, spawning activity in recent years in the lower American River, for example, has peaked during mid- to late-November (CDFG 1992; CDFG 1995). In general, the fall-run Chinook salmon spawning and embryo incubation period extends from October through March (NMFS 2004; Vogel and Marine 1991). It should also be noted that if water temperature conditions are sufficiently low (i.e., ≤ 60°F), spawning activity may begin in September (Moyle 2002).

The intra-gravel residence times of incubating eggs and alevins (yolk-sac fry) are highly dependent upon water temperatures. The intra-gravel egg and fry incubation life stage for Chinook salmon generally extends from about mid-October through March.

Within the regional study area, fall-run Chinook salmon fry emergence generally occurs from late-December through March (Moyle 2002). In the Feather River, fall-run Chinook salmon fry emergence has been reported to occur as early as November (Seesholtz *et al.* 2003). In the Sacramento River Basin, fall-run Chinook salmon juvenile emigration occurs from January through June (Moyle 2002; Vogel and Marine 1991). Emigration surveys conducted by CDFG have shown no evidence that peak emigration of Chinook salmon is related to the onset of peak spring flows in the lower American River (Snider *et al.* 1997). Temperatures required during emigration are believed to be about the same as those required for successful rearing, as discussed below.

Water temperatures reported to be optimal for rearing of Chinook salmon fry and juveniles are reported to be between 45°F and 65°F (NMFS 2002a; Rich 1987; Seymour 1956). Raleigh *et al.* (Raleigh *et al.* 1986) reviewed the available literature on Chinook salmon thermal requirements and suggested a suitable rearing temperature range of approximately 53.6°F to 64.4°F, and an upper limit of 75°F. Zedonis and Newcomb (Zedonis and Newcomb 1997) report that the smoltification process may become compromised at water temperatures above 62.6°F.

Late Fall-run Chinook Salmon

Most late fall-run Chinook salmon spawn in the Sacramento River; therefore, this species account is specific to the Sacramento River (USFWS 1995d). Adult immigration and holding of late fall-run Chinook salmon in the Sacramento River generally begins in October, peaks in December, and ends in April (Moyle 2002). Late fall-run Chinook salmon spawn during periods of high flows, when flow fluctuations can be damaging to redds constructed in high terraces, which can be exposed as water recedes (USFWS 1995d). Spawning also has been suggested to occur in tributaries to the upper Sacramento River (e.g., Battle, Cottonwood, Clear, Big Chico, Butte and Mill creeks) and the Feather and Yuba rivers, although these fish do not comprise a large proportion of the late fall-run Chinook population (USFWS 1995d). Spawning in the mainstem Sacramento River occurs primarily from Keswick Dam (River Mile (RM) 302) to Red Bluff Diversion Dam (RM 258), and generally occurs from January through April (Moyle 2002; NMFS 2004; Vogel and Marine 1991). Late fall-run Chinook salmon embryo incubation can extend through June (Vogel and Marine 1991). Post-emergent fry and juveniles emigrate from their spawning and rearing grounds in the upper Sacramento River and its tributaries during the April through December period (Vogel and Marine 1991). NMFS recognizes the late fall-run Chinook salmon in the Central Valley as part of the fall-run Chinook salmon ESU (Moyle 2002).

STEELHEAD

The Central Valley steelhead DPS is listed as a "threatened" species under the federal ESA, and has no state listing status. Central Valley steelhead occur in the Sacramento, Feather, American and Yuba rivers, and also have been found in the Stanislaus and Mokelumne rivers. Steelhead are produced at the Coleman Fish Hatchery on Battle Creek, the Nimbus Hatchery on the American River, and the Feather River Hatchery on the Feather River (McEwan and Jackson 1996).

Most wild, indigenous populations of steelhead occur in upper Sacramento River tributaries below the Red Bluff Diversion Dam, including Antelope, Deer, and Mill creeks, and the Yuba River. Remnant populations may also exist in Big Chico and Butte creeks (McEwan and Jackson 1996). Naturally spawning populations also occur in the American and Feather rivers, and possibly the upper Sacramento and Mokelumne rivers, but these populations have had substantial hatchery influence and their ancestry is not clearly known (Busby *et al.* 1996). Steelhead runs in the Feather and American rivers are sustained largely by Feather River and Nimbus (American River) hatcheries (McEwan and Jackson 1996).

Estimates of steelhead run sizes have been sporadic and limited to only a few locations over the last 50 years. The average annual run size in the Sacramento River above the mouth of the Feather River during 1953 through 1958 was estimated at 20,540 fish (Hallock 1989). Although an accurate estimate is not available, the recent annual run size for the entire Sacramento River Basin, based on Red Bluff Diversion Dam counts, hatchery counts, and available natural spawning escapement estimates, is probably fewer than 10,000 fish (McEwan and Jackson 1996). The most reliable indicators of recent declines in hatchery and wild stocks are trends reflected in Red Bluff Diversion Dam and hatchery counts. Annual counts at the Red Bluff Diversion Dam declined from an average of 11,187 adult fish in the late 1960s and 1970s to 2,202 adult fish in the 1990s. Recent counts at Coleman, Feather River, and Nimbus hatcheries also are well below the historical averages. Frank Fisher (CDFG) estimated that 10 percent to 30 percent of adults returning to spawn in the Sacramento River system are of hatchery origin (McEwan and Jackson 1996).

Central Valley steelhead are known to use the Sacramento River as a migratory corridor to spawning areas in upstream tributaries. Historically, steelhead likely did not utilize the mainstem Sacramento River downstream from the Shasta Dam site except as a migratory corridor to and from headwater streams. The number of steelhead that spawn in the Sacramento River is unknown, but it is probably low (DWR 2003b).

In analyzing flow-habitat relationships for anadromous salmonids in the upper Sacramento River, upstream of the Battle Creek confluence and downstream from Keswick Dam, USFWS reports very few steelhead redds have been observed in CDFG aerial redd surveys and, of those redds observed, it was not possible to distinguish steelhead redds from resident rainbow trout redds (USFWS 2003). Recent population estimates suggest two-thirds (approximately 2,000 adults) of wild Central Valley steelhead spawn upstream of the Red Bluff Diversion Dam and the majority of these spawners probably return to Battle Creek due to the presence of the Coleman National Fish Hatchery. Specific information regarding steelhead spawning within the mainstem Sacramento River is limited due to lack of monitoring (NMFS 2004). NMFS does not know how many steelhead spawn in the upper Sacramento River because they cannot be distinguished from the sizeable resident trout population that has developed as a result of managing for coldwater species in the Sacramento River all summer. NMFS assumes that most of the adult steelhead passing the Red Bluff Diversion Dam spawn in tributaries because the habitat is more suitable.

Adult steelhead immigration into Central Valley streams typically begins in August and continues into March (McEwan 2001; NMFS 2004). Steelhead immigration generally peaks during January and February (Moyle 2002). Optimal immigration and holding temperatures have been reported to range from 46°F to 52°F (CDFG 1991b). Spawning usually begins during late-December and may extend through March, but also can range from November through April (CDFG 1986). Optimal spawning temperatures have been reported to range from 39°F to 52°F (CDFG 1991b). Unlike Chinook salmon, many steelhead do not die after spawning. Those that survive return to the ocean, and may spawn again in future years.

Optimal egg incubation temperatures have been reported to range from 48°F to 52°F (CDFG 1991b). Preferred water temperatures for fry and juvenile steelhead rearing are reported to range from 45°F to 65°F (NMFS 2002a). Each degree increase between 65°F and the upper lethal limit of 75°F reportedly becomes increasingly less suitable and thermally more stressful for the fish (Bovee 1978). Although the reported preferred water temperatures for fry and juvenile steelhead rearing range from 45°F to 65°F, most of the literature on steelhead smoltification suggest water temperatures of 52°F (Adams *et al.* 1975; Myrick and Cech 2001; Rich 1987), or less than 55°F (EPA 2003; McCullough *et al.* 2001; Wedemeyer *et al.* 1980; Zaugg and Wagner 1973) are required for successful smoltification to occur. The primary period of steelhead smolt emigration occurs from March through June (Castleberry *et al.* 1991). It has been reported that steelhead move downstream as young-of-the-year (YOY) in the lower Yuba River (YCWA 2005) and in the lower American River (Snider and Titus 2000b) from late-spring through summer.

GREEN STURGEON

On April 5, 2005, NMFS filed a proposed rule to list the southern population of North American green sturgeon as threatened under the ESA. On April 7, 2006, a final rule was issued and adopted, and the southern DPS was listed as threatened. The final rule became effective June 6, 2006 (71 FR 17757 (April 7, 2006)). NMFS (2005a) states that the main factor for the decline of the southern DPS of green sturgeon is the reduction of spawning habitat in the Sacramento and Feather rivers.

Green sturgeon is an anadromous species, migrating from the ocean to freshwater to spawn. Adults of this species tend to be more marine-oriented than the more common white sturgeon. Nevertheless, spawning populations have been identified in the Sacramento River, and most spawning is believed to occur in the upper reaches of the Sacramento River as far north as Red Bluff (Moyle *et al.* 1995). Adults begin their inland migration in late-February (Moyle *et al.* 1995), and enter the Sacramento River between February and late-July (CDFG 2001). In the Klamath River, the water temperature tolerance of immigrating adult green sturgeon reportedly ranges from 44.4°F to 60.8°F. Reportedly, no green sturgeon were found in areas of the river outside this surface water temperature range (USFWS 1995d). Spawning activities occur from March through July, with peak activity believed to occur between April and June (Moyle *et al.* 1995). Green sturgeon reportedly tolerate spawning water temperatures ranging from 50°F to 70°F (CDFG 2001). Water temperatures above 68°F (20°C) are reportedly lethal to green sturgeon embryos (Beamesderfer and Webb 2002). Small numbers of juvenile green sturgeon have been captured and identified each year from 1986 through 2001 in the Sacramento River at the Hamilton City Pumping Plant (RM 206) and at Red Bluff Diversion Dam from 1995 through 2001 (NMFS 2002b). Juvenile green sturgeon reportedly rear in their natal streams year-round (Environmental Protection Information Center *et al.* 2001; Moyle 2002). Growth of juvenile green sturgeon is reportedly optimal at 59°F (15°C) and reduced at both 51.8°F (11°C) and 66.2°F (19°C) (Cech *et al.* 2000). Within the Klamath River, juvenile green sturgeon emigration reportedly occurs from late May through July (Environmental Protection Information Center *et al.* 2001). Within the Trinity River, juvenile green sturgeon emigration reportedly occurs from early June through September (Environmental Protection Information Center *et al.* 2001). Although a green sturgeon sport fishery exists on the lower Feather River, the extent to which green sturgeon use the Feather River is still to be determined. Green sturgeon larvae are occasionally captured in salmon outmigrant traps, suggesting the lower Feather River may be a spawning area (Moyle 2002). However, NMFS (2002b) reports that green sturgeon spawning in the Feather River is unsubstantiated.

AMERICAN SHAD

American shad occur in the Sacramento River, its major tributaries, the San Joaquin River and the Delta. Because of its importance as a sport fish, American shad have been the subject of investigations by CDFG. American shad are native to the Atlantic coast and were planted in the Sacramento River in 1871 and 1881 (Moyle 2002).

Adult American shad typically enter Central Valley rivers from April through early July (CDFG 1986), with the majority of immigration and spawning occurring from mid-May through June (Urquhart 1987). Water temperature is an important factor influencing the timing of spawning. American shad are reported to spawn at water temperatures ranging from approximately 46°F to 79°F (USFWS 1967), although optimal spawning temperatures are reported to range from about 60ºF to 70°F (Bell 1986; CDFG 1980; Leggett and Whitney 1972; Painter *et al.* 1979; Rich 1987). Spawning takes place mostly in the main channels of rivers, and generally about 70 percent of the spawning run is made up of first time spawners (Moyle 2002).

Shad have remarkable abilities to navigate and to detect minor changes in their environment (Leggett 1973). Although homing is generally assumed in the Sacramento River and its tributaries, there is some evidence that numbers of first-time spawning (i.e., "virgin") fish are proportional to flows of each river at the time the shad arrive. When suitable spawning conditions are found, American shad school and broadcast their eggs throughout the water column. The optimal temperature for egg development is reported to occur at 62°F. At this temperature, eggs hatch in six to eight days; at temperatures near 75°F, eggs would hatch in three days (MacKenzie *et al.* 1985). Egg incubation and hatching, therefore, are coincident with the spawning period.

STRIPED BASS

Striped bass occur in the Sacramento River, its major tributaries, and the Delta. Substantial striped bass spawning and rearing occurs in the Sacramento River and Delta, although striped bass can typically be found upstream as far as barrier dams (Moyle 2002). Striped bass are native to the Atlantic coast. They were first introduced to the Pacific coast in 1879, when they were planted in the San Francisco Estuary (Moyle 2002).

Adult striped bass are present in Central Valley rivers throughout the year, with peak abundance occurring during the spring months (CDFG 1971; DeHaven 1979; DeHaven 1977). Striped bass spawn in water temperatures ranging from 59°F to 68°F (Moyle 2002). Therefore, spawning may begin in April, but peaks in May and early-June (Moyle 2002). In the Sacramento River, most striped bass spawning is believed to occur between Colusa and the mouth of the Feather River. In years of higher flow, spawning typically occurs further upstream than usual because striped bass continue migrating upstream while waiting for temperatures to rise (Moyle 2002). No studies have definitively determined whether striped bass spawn in certain tributaries, including the lower American and Feather River (CDFG 1971; CDFG 1986; DWR 2001). Sacramento River currents carry striped bass embryos and larvae to rearing habitats in the Delta.

The number of striped bass entering Central Valley streams during the summer is believed to vary with flow levels and food production (CDFG 1986). Sacramento River tributaries seem to be nursery areas for young striped bass (CDFG 1971; CDFG 1986). Juvenile and sub-adult fish have been reported to be abundant in the lower American River and lower Yuba River during the fall (DeHaven 1977). Optimal water temperatures for juvenile striped bass rearing have been reported to range from approximately 61°F to 73°F (USFWS 1988).

DELTA SMELT

The USFWS listed delta smelt as a "threatened" species under the ESA in March 1993 (CFR 58 12854), and critical habitat for delta smelt has been designated within the area. Delta smelt also is listed as a "threatened" species under the CESA. In addition to the Delta, delta smelt have been found in the Sacramento River as far upstream as the confluence with the American River (Moyle 2002; USFWS 1994). This species also occurs in the San Joaquin River, downstream of Vernalis (Reclamation and San Joaquin River Group Authority 1999).

Delta smelt are a euryhaline fish, native to the Sacramento-San Joaquin estuary. As a euryhaline species, delta smelt tolerate wide-ranging salinities, but rarely occur in waters with salinities greater than 10 ppt to 14 ppt (Baxter *et al.* 1999). Similarly, delta smelt tolerate a wide-range of water temperatures, as they have been found at water temperatures ranging from 42.8°F to 82.4°F (Moyle 2002). Delta smelt are typically found within Suisun Bay and the lower reaches of the Sacramento and San Joaquin rivers, although they are occasionally collected within the Carquinez Strait and San Pablo Bay. The delta smelt is a small slender bodied fish, with a typical adult size of 2 to 3 inches, although some individuals may reach lengths of 5 inches.

During the late winter and spring, delta smelt migrate upstream into freshwater areas to spawn. Shortly before spawning, adults migrate upstream from the brackish-water estuarine areas into river channels and tidally influenced backwater sloughs. In the Sacramento-San Joaquin river system, delta smelt spawning reportedly occurs from February through May, with embryo incubation extending through June (Wang 1986). Delta smelt are thought to spawn in shallow fresh or slightly brackish waters in tidally influenced backwater sloughs and channel edgewaters (Wang 1986). While most delta smelt spawning seems to take place at 44.6°F to 59°F, gravid delta smelt and recently hatched larvae have been collected at 59°F to 71.6°F. Thus, it is likely that spawning can take place over the entire range of 44.6°F to 71.6°F (Moyle 2002). Females generally produce between 1,000 and 2,600 eggs (Bennett 2005), which adhere to vegetation and other hard substrates. Larvae hatch in between 10 and 14 days (Wang 1986) and are planktonic (float with water currents) as they are transported and dispersed downstream into the low-salinity areas within the western delta and Suisun Bay (Moyle 2002). Delta smelt grow rapidly, with the majority of smelt living only one year. Most adult smelt die after spawning in the early spring; although they may be capable of spawning twice during a season, (Bennett 2005; Brown and Kimmerer 2001; Moyle 2002). Delta smelt feed entirely on zooplankton. For the majority of their one-year life span, delta smelt inhabit areas within the western Delta and Suisun Bay characterized by salinities of approximately 2 ppt. Historically, they have been abundant in low (around 2 ppt) salinity habitats. Delta smelt occur in open surface waters and shoal areas (USFWS 1994). Critical habitat for delta smelt is defined as follows:

> *"Areas and all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma Sloughs; and the existing contiguous waters contained within the Delta."* (USFWS 1994).

Because delta smelt typically have a one-year life span, their abundance and distribution have been observed to fluctuate substantially within and among years. Delta smelt abundance appears to be reduced during years characterized by either unusually dry years with exceptionally low outflows (e.g. 1987 through 1991) and unusually wet years with exceptionally high outflows (e.g. 1982 and 1986). Other factors thought to affect the abundance and distribution of delta smelt within the Bay-Delta estuary include entrainment in water diversions, changes in the zooplankton community resulting from introductions of non-native species, and potential effects of toxins.

SACRAMENTO SPLITTAIL

USFWS removed Sacramento splittail from the list of threatened species on September 22, 2003, and did not identify it as a candidate for listing under the ESA. Sacramento splittail are however, identified as a California species of special concern and, informally, as a federal species of concern. Splittail occur in the Sacramento River, its major tributaries, the San Joaquin River and the Delta.

Sacramento splittail spawning can occur anytime between late February and early July but peak spawning occurs in March and April (Moyle 2002). DWR (2004a) reported that Sacramento splitttail spawning, egg incubation and initial rearing in the Feather River primarily occurs during February through May. A gradual upstream migration begins in the winter months to forage and spawn, although some spawning activity has been observed in Suisun Marsh (Moyle 2002). During wet years, upstream migration is much more directed and fish tend to swim further upstream (Moyle 2002). Attraction flows are necessary to initiate travel onto floodplains where spawning occurs (Moyle *et al.* 2004). Spawning generally occurs in water with depths of three to six feet over submerged vegetation where eggs adhere to vegetation or debris until hatching (Moyle 2002; Wang 1986). Caywood (1974) reports older fish are generally the first to spawn.

Eggs normally incubate for three to seven days depending on water temperature (Moyle 2002). After hatching, splittail larvae remain in shallow weedy areas until water recedes, and they migrate downstream (Meng and Moyle 1995). The largest catches of Sacramento splittail larvae occurred in 1995, a wet year when outflow from inundated areas peaked during March and April (Meng and Matern 2001).

Juvenile Sacramento splittail prefer shallow-water habitat with emergent vegetation during rearing (Meng and Moyle 1995). Sommer et al. (Sommer *et al.* 2002) reports juvenile splittail are more abundant in the Yolo Bypass floodplain in the shallowest areas of the wetland with emergent vegetation. Juvenile splittail are classified as benthic foragers (USFWS 1995b). Downstream movement of juvenile splittail appears to coincide with drainage from the floodplains between May and July (Caywood 1974; Meng and Moyle 1995; Sommer *et al.* 1997).

Sacramento splittail attain sexual maturity by the end of their second winter at a length of 180 to 200 mm (Daniels and Moyle 1983). Normal lifespan of Sacramento splittail ranges from five to seven years (Caywood 1974; Meng and Moyle 1995). Adults can attain a length of over 300 mm (USFWS 1995b). Adults are normally found in relatively shallow (<12 feet) water in brackish tidal sloughs, such as Suisun Marsh, but can also occur in freshwater areas with either tidal or riverine flows (Moyle *et al*. 2004). Splittail are also known to withstand very low dissolved oxygen levels (<1 mg O2 l-1), a wide range of water temperatures (41.0˚F to 75.2˚F) and salinities of 6 – 10 ppt (Moyle *et al*. 2004).

Floodplain inundation during March and April appears to be the primary factor contributing to splittail abundance. Sommer (Sommer Unpublished Work) speculates that during dry years, the frequency and duration of floodplain inundation is not sufficient to support high levels of foraging, spawning and rearing. Moyle (Moyle *et al*. 2004) reports that moderate to strong year classes of splittail develop when floodplains are inundated for six to ten weeks between late February and late April. Reportedly, when floodplains are inundated for less than a month, strong year classes are not produced (Sommer *et al*. 1997).

Sommer et al. (1997) discuss the resiliency of splittail populations and suggest that because of their relatively long life span, high reproductive capacity and broad environmental tolerances, splittail populations have the ability to recover rapidly even after several years of drought conditions. This suggests that frequent floodplain inundations are not necessary to support a healthy population. Moyle (Moyle *et al*. 2004) reports that the ability of at least a few splittail to reproduce even under the worst flow conditions insures that the population will persist indefinitely, despite downward trends in total population size during periods of drought.

HARDHEAD

Hardhead is a large (occasionally exceeding 600 mm standard length [SL]), native cyprinid species that generally occurs in large, undisturbed low- to mid-elevation rivers and streams of the region (Moyle 2002). The species is widely distributed throughout the Sacramento-San Joaquin River system, though it is absent from the valley reaches of the San Joaquin River. Hardhead mature following their second year. Spawning migrations, which occur in the spring into smaller tributary streams, are common. The spawning season may extend into August in the foothill streams of the Sacramento and San Joaquin River basins. Spawning behavior has not been documented, but hardhead are believed to elicit mass spawning in gravel riffles (Moyle 2002). Little is known about life stage specific temperature requirements of hardhead; however, temperatures ranging from approximately 65°F to 75°F are believed to be suitable (Cech *et al*. 1990).

LONGFIN SMELT

Longfin smelt is a euryhaline species. This is particularly evident in the Delta where they are found in areas ranging from almost pure seawater upstream to areas of pure freshwater. In this system, they are most abundant in San Pablo and Suisun bays (Moyle 2002). They tend to inhabit the middle to lower portion of the water column. The longfin smelt spends the early summer in San Pablo and San Francisco bays, generally moving into Suisun Bay in August. Most spawning is from February to April at water temperatures of 44.6°F to 58.1°F (Moyle 2002). The majority of adults perish following spawning. Longfin smelt eggs have adhesive properties and are probably deposited on rocks or aquatic plants upon fertilization. Newly hatched longfin smelt are swept downstream into more brackish parts of the estuary. Strong

Delta outflow is thought to correspond with longfin smelt survival, as higher flows transport longfin smelt young to more suitable rearing habitat in Suisun and San Pablo bays (Moyle 2002). Longfin smelt are rarely observed upstream of Rio Vista in the Delta (Moyle *et al.* 1995).

RIVER LAMPREY

The anadromous river lamprey is found in coastal streams from San Francisco Bay to Alaska (Moyle 2002). Adults migrate back into freshwater in the fall and spawn from April to June in small tributary streams (Wang 1986). River lamprey are reported to spawn at water temperatures ranging from 55.4°F to 56.3°F (Wang 1986). Adults die after spawning. Presumably, the adults need clean, gravelly riffles in permanent streams for spawning, while the ammocoetes require sandy backwaters or stream edges in which to bury themselves, where water quality is continuously high and water temperatures do not exceed 77°F. Ammocoetes begin their transformation into adults when they are about 12 cm TL, during the summer. The process of metamorphosis may take nine to 10 months, the longest known for any lamprey species. Lampreys in the final stages of metamorphosis congregate immediately upriver from saltwater and enter the ocean in late spring. Adults apparently only spend three to four months in saltwater, where they grow rapidly, reaching 25 cm to 31 cm TL (Moyle 2002).

SACRAMENTO PERCH

Sacramento perch are deep-bodied, laterally compressed centrarchids. Historically, Sacramento perch were found throughout the Central Valley, the Pajaro and Salinas rivers, and Clear Lake. The only populations today that represent continuous habitation within their native range are those in Clear Lake and Alameda Creek. Within their native range, Sacramento perch exist primarily in farm ponds, reservoirs, and lakes into which they have been introduced (Moyle 2002). Sacramento perch are often associated with beds of rooted, submerged, and emergent vegetation and other submerged objects. Sacramento perch are able to tolerate a wide range of physicochemical water conditions. This tolerance is thought to be an adaptation to fluctuating environmental conditions resulting from floods and droughts. Thus, Sacramento perch do well in highly alkaline water (McCarraher and Gregory 1970; Moyle 1976). Most populations today are established in warm, turbid, moderately alkaline reservoirs or farm ponds. Spawning occurs during spring and early summer and usually begins by the end of March, continuing through the first week of August (Mathews 1965; Moyle 2002). Introductions of non-native species, not necessarily habitat alterations, are foremost in the cause of Sacramento perch declines (Moyle 2002).

SAN JOAQUIN ROACH

The San Joaquin roach, a native freshwater minnow, is found throughout the Sacramento-San Joaquin drainage system (Moyle 2002). California roach, of which the Pit and San Joaquin roaches are a subspecies, are generally found in small, warm intermittent streams, and dense populations are frequently found in isolated pools (Moyle *et al.* 1982; Moyle 2002). They are most abundant in mid-elevation streams in the Sierra foothills and in the lower reaches of some coastal streams (Moyle 2002). Roach are tolerant of relatively high temperatures (86°F to 95°F) and low oxygen levels (1 ppm to 2 ppm) (Taylor *et al.* 1982). Roach reach sexual maturity by about the second year (approximately 45 mm SL). Reproduction generally occurs from March to June, usually when temperatures exceed 60.8°F, but may be extended through late July (Moyle 2002).

10.1.2 YUBA REGION

The Yuba River study area includes New Bullards Bar and Englebright reservoirs, and the lower Yuba River, extending from Englebright Dam to the confluence with the Feather River. A complete description of the Yuba River Basin, the Yuba Project and its operation is presented in Chapter 5. Details regarding the water bodies associated with the Yuba River and the fisheries resources they support are provided below.

10.1.2.1 NEW BULLARDS BAR RESERVOIR

New Bullards Bar Reservoir supports both coldwater and warmwater fisheries consisting of rainbow trout, kokanee salmon, brown trout, largemouth bass, smallmouth bass, crappie, sunfish, and bullhead (DWR 2000). Although warmwater fish species, both centrarchids and ictalurids (crappie, largemouth and smallmouth bass, and sunfish), are known to occur in New Bullards Bar Reservoir, limited recreational fisheries exist for these warmwater fish species. New Bullards Bar Reservoir supports a very significant salmonid fishery emphasizing kokanee salmon. In fact, New Bullards Bar Reservoir is known for having some of the best kokanee salmon fishing in the State of California (U.C. Davis Website 2004). A detailed explanation of both cold water and warm water fish habitat utilization, particularly as they apply to potential changes in reservoir operations, can be found in Section 10.2.1.5.

10.1.2.2 ENGLEBRIGHT RESERVOIR

Englebright Reservoir is located downstream of New Bullards Bar Reservoir. With a storage capacity of approximately 70 TAF, Englebright Reservoir essentially serves as a re-regulating afterbay for New Bullards Bar Reservoir and fluctuates on a frequent basis. Englebright Reservoir supports warmwater (both centrarchids and ictalurids) and coldwater fish species, including rainbow and brown trout, and kokanee salmon (USACE Website 2005). Transfer water that is released from New Bullards Bar Reservoir generally passes through Englebright Reservoir without modifying Englebright Reservoir elevations (YCWA and SWRCB 2001). Because Englebright Reservoir serves as a re-regulating afterbay and would serve as a flow-through facility for Proposed Yuba Accord water, warmwater and coldwater fishery resources at this facility would not be affected by implementation of the Proposed Yuba Accord. Therefore, a discussion of potential effects on Englebright Reservoir fishery resources is not included in this analysis.

10.1.2.3 LOWER YUBA RIVER

Based on general differences in hydraulic conditions, channel morphology, geology, water conditions, and fish species distribution, Beak Consultants (CDFG 1989) divided the lower Yuba River into the following four reaches.

Narrows Reach – extends from Englebright Dam to the downstream terminus of the Narrows (RM 23.9 to RM 21.9); topography is characterized by steep canyon walls;

Garcia Gravel Pit Reach – extends from the Narrows downstream to Daguerre Point Dam (RM 21.9 to RM 11.5);

Daguerre Point Dam Reach – extends from Daguerre Point Dam downstream to the upstream area of Feather River backwater influence (just east of Marysville; RM 11.5 to RM 3.5); and

Simpson Lane Reach – begins at the upstream area of Feather River backwater influence and extends to the confluence with the Feather River (RM 3.5 to RM 0).

The lower Yuba River consists of the approximately 24-mile stretch of river extending from Englebright Dam, the first impassible fish barrier along the river, downstream to the confluence with the Feather River near Marysville. Water projects operated by PG&E, NID, and South Feather River Water and Power Agency export up to approximately 530 TAF of water per year into adjacent basins. Once exported, this water is not available to the lower Yuba River.

SPRING-RUN CHINOOK SALMON

Spring-run Chinook salmon cannot reliably be distinguished from fall-run Chinook salmon during spawning, rearing and emigration periods because of overlapping spawning periods, juvenile sizes, and other life history traits (YCWA 2000b). Reported information on the life history and habitat requirements of Central Valley spring-run Chinook salmon can be found in the *Report to the Fish and Game Commission: A Status Review of the Spring-Run Chinook Salmon* (CDFG 1998) and *Habitat Restoration Actions to Double Natural Production of Anadromous Fish in the Central Valley of California* (USFWS 1995d).

The Central Valley spring-run Chinook salmon is listed as a threatened ESU under both the federal and state ESAs. Critical habitat for this ESU, which includes the lower Yuba River, was designated on September 2, 2005. Several factors have contributed to the state and federally "threatened' status of Central Valley spring-run Chinook salmon. Major in-basin factors contributing to the decline were migration barriers, hydraulic mining, and water diversions. Hydraulic mining in the Yuba River watershed from 1850 to 1885 caused extensive habitat destruction. Between 1900 and 1941, debris dams constructed by the California Debris Commission, now owned and operated by the Corps on the lower Yuba River to retain hydraulic mining debris, completely or partially blocked the migration of Chinook salmon and steelhead to historic spawning and rearing habitats (CDFG 1991b; Wooster and Wickwire 1970; Yoshiyama *et al.* 1996). Water diversions also contributed to poor habitat conditions below the dams, especially in dry years. Today, Englebright Dam, completed in 1941 by the California Debris Commission and now owned and operated by the Corps, completely blocks spawning runs of Chinook salmon and steelhead, and is the upstream limit of fish migration. Since the completion of New Bullards Bar Reservoir in 1970 by YCWA, higher, colder flows in the lower Yuba River have improved conditions for over-summering and spawning of spring-run Chinook salmon in the lower Yuba River.

Adult spring-run Chinook salmon immigration and holding has previously been reported to primarily occur in the Yuba River from March through October (Vogel and Marine 1991), with upstream migration generally peaking in May (SWRI 2002). Relatively small numbers of Chinook salmon that exhibit spring-run phenotypic characteristics have been observed in the lower Yuba River (CDFG 1998). Although precise escapement estimates are not available, the USFWS testified at the 1992 SWRCB lower Yuba River hearing that "*…a population of about 1,000 adult spring-run Chinook salmon now exists in the lower Yuba River*" (San Francisco Bay RWQCB 2006). The installation of a VAKI Riverwatcher fish imaging system in the North and South Fish Ladders at Daguerre Point Dam in 2003 has provided an opportunity to count Chinook salmon as they migrate through the lower Yuba River. During 2005, the year in which the VAKI system operated continuously during the February through June period, 1,021 Chinook salmon (including grilse) were observed (CDFG, preliminary, unpublished data). Only four Chinook salmon were observed passing Daguerre Point Dam during the month of February; most Chinook salmon passing Daguerre Point Dam during this period were observed during the month of June. The recent VAKI system observations have not been used to attempt to estimate the total spring-run Chinook salmon escapement in the lower Yuba River. Also, the origins of the early migrating and spawning fish and their genetic relationship with fall-run Chinook salmon are unknown. Hatchery-reared spring-run Chinook salmon were planted in the lower Yuba River during the 1970s and adipose fin-clipped (e.g., hatchery) Chinook salmon have been observed both by the VAKI system and during carcass surveys.

Adult Chinook salmon prefer to hold in run and pool habitats during their upstream migration to spawning areas. Preferred holding water depths for these habitats are usually greater than 6.2 feet (Moyle 2002). In the lower Yuba River, adult spring-run Chinook salmon apparently hold over the summer in the deep pools and cool water downstream of the Narrows I and Narrows II powerhouses, or further downstream in the Narrows Reach (CDFG 1991a; SWRCB 2003), where water depths can exceed 40 feet. The acceptable water temperature range for adults immigrating upstream and holding is reported to be 57°F to 67°F (NMFS 1997). Elevated water temperatures and increased adult holding habitat densities can influence the number and virulence of common microparisites affecting immigrating adult salmonids (Spence *et al.* 1996). Water temperatures above 64°F reportedly could cause the many diseases that commonly affect immigrating and holding Chinook salmon to become virulent (EPA 2001).

In the Central Valley, spring-run Chinook salmon spawning has been reported to primarily occur during September through mid-November, with spawning peaking in mid-September (DWR 2004c; DWR 2004d; Moyle 2002; Vogel and Marine 1991). Historically, September was the peak month of spring-run Chinook salmon spawning, although some temporal overlap with fall-run Chinook salmon occurs (CDFG 2002; Myrick and Cech 2001; Rich 1987; San Franciso Bay RWQCB 2006). In the lower Yuba River, spring-run Chinook salmon spawning is believed to occur from September through November. Chinook salmon redd surveys in the lower Yuba River have been conducted during late August through September by CDFG since 2000. In the lower Yuba River, Chinook salmon redds have been observed in the Garcia Gravel Pit Reach (primarily above Parks Bar) by mid-September. The number of Chinook salmon redds observed by CDFG during September has ranged between 66 and 288 during 2000 through 2005, although redd superimposition during some years has precluded accurate redd counts. Characteristics of spawning habitats that are directly related to flow include water depth and velocity. Chinook salmon spawning reportedly occurs in water velocities ranging from 1.2 ft/s to 3.5 ft/s. Chinook salmon redd construction and spawning typically occurs at water depths greater than 0.5 feet.

Spring-run Chinook embryo incubation primarily occurs in the lower Yuba River from September through March (CALFED and YCWA 2005). The intragravel residence times of incubating eggs and alevins (yolk-sac fry) are highly dependent upon water temperatures. Maximum Chinook salmon embryo survival reportedly occurs in water temperatures ranging from 41°F to 56°F (USFWS 1995d).

In general, spring-run Chinook salmon juvenile rearing is believed to extend year-round (Moyle 2002), and is considered to extend-year round in the lower Yuba River. Snorkeling and beach seining surveys have been conducted in the lower Yuba River sporadically since 1992. Specifically, fish population surveys using direct observation (including snorkeling) were conducted to evaluate annual and seasonal patterns of abundance and distribution of juvenile Chinook salmon and steelhead during the spring and summer rearing periods. On the lower Yuba River, snorkeling has been considered to be an effective means of obtaining juvenile fish information because divers can effectively gather presence or absence, relative abundance, distribution, habitat preferences, and sizes of fish throughout the river (SWRI *et al.* 2000). In general, juvenile Chinook salmon have been observed throughout the lower Yuba River, but with higher abundances above Daguerre Point Dam. This may be due to larger numbers of spawners, greater amounts of more complex, high-quality cover, and lower densities of predators such as striped bass and American shad, which reportedly are restricted to areas below the dam. During juvenile rearing and smolt emigration, salmonids prefer stream margin habitats with sufficient depths and velocities to provide suitable cover and foraging opportunities. Juvenile Chinook salmon reportedly utilize river channel depths ranging from 0.9 feet to 2.0 feet, and most frequently utilize water velocities ranging from 0 ft/s to 1.3 ft/s (Raleigh *et al.* 1986). The water temperature reported for maximum growth of juvenile Central Valley Chinook salmon is 66.2°F (Cech and Myrick 1999).

The timing of juvenile emigration from the spawning and rearing grounds varies among the tributaries of origin, and can occur during the period extending from October through April (Vogel and Marine 1991). Although it has been previously suggested that spring-run Chinook salmon smolt emigration generally occurs from November through June in the lower Yuba River (CALFED and YCWA 2005; CDFG 1998; SWRI 2002), recent (1999-2005) CDFG monitoring data indicate that the vast majority of spring-run Chinook salmon emigrate as post-emergent fry during November and December, with a relatively small percentage of individuals remaining in the lower Yuba River and emigrating as YOY from January through April.

FALL-RUN CHINOOK SALMON

The fall-run Chinook salmon population in the Yuba River was substantially reduced before the 1950s by extensive mining, agriculture, urbanization, and commercial fishing. However, since 1950 natural production of fall-run Chinook salmon in the lower Yuba River has sustained or slightly increased the same average population levels despite continued and increasing out-of-basin stressors that have acted to further limit survival of Chinook salmon in the lower Sacramento River, Delta and Pacific Ocean.

CDFG began making annual estimates of fall-run Chinook salmon spawning escapement (the number of salmon that "escape" the commercial and sport fisheries in the Pacific Ocean and return to spawn in the lower Yuba River) in 1953. From 1953 to 1971, these estimates ranged from 1,000 fish in 1957 to 37,000 fish in 1963, and averaged 12,906 fish. From 1972 to 2004, the annual average run of Chinook salmon was 16,004 fish. Assuming CDFG's traditional 15.5 percent estimated contribution to total escapement, the average for the 1972-2004 period is 14,749 fish (YCWA 2006b). It is important to note that a direct comparison between survey years is complicated by inconsistent experimental methodologies. For example, early CDFG studies often covered a limited portion of the spawning area or spawning period. In addition, standardized mark and recapture (Schaefer) methods were not utilized until about 1978 (J. Nelson, CDFG, 2006, pers comm.), and it is difficult to determine the specific methods utilized to expand direct observations during the earlier studies.

The fall-run Chinook salmon population in the lower Yuba River is sustained largely by natural production. Trends in natural production can be masked by large numbers of returning hatchery spawners in rivers with major hatcheries or planting programs, or where significant straying of hatchery fish occurs. No hatchery or long-term planting program exists on the lower Yuba River. Analyses of straying of hatchery Chinook salmon in the Sacramento River Basin indicate a relatively low degree of straying hatchery spawners to the lower Yuba River (Cramer 1990), although data presently being collected at Daguerre Point Dam using the VAKI Riverwatcher system may further elucidate this issue in the future.

Adult fall-run Chinook salmon immigration and holding generally occurs in the lower Yuba River from August through November (CALFED and YCWA 2005). Adult fall-run Chinook salmon generally begin migrating upstream annually in July, with minimal immigration continuing through December in most years (NMFS 2004; Vogel and Marine 1991). Adult fall-run Chinook salmon immigration generally peaks in November, and typically greater than 90 percent of the run has entered the river by the end of November (CDFG 1992; CDFG 1995). The immigration timing of fall-run Chinook salmon tends to be temporally similar from year-to-year because it is largely dictated by cues (photoperiod, maturation, and other season environmental cues) that exhibit little year-to-year variation.

The timing of adult Chinook salmon spawning activity is strongly influenced by water temperatures. When daily average water temperatures decrease to approximately 60°F, female Chinook salmon begin to construct nests (redds) into which their eggs (simultaneously fertilized by males) are eventually released. Fertilized eggs are subsequently buried with streambed gravel. In general, the lower Yuba River fall-run Chinook salmon spawning and embryo incubation period extends from October through December (CALFED and YCWA 2005). It should also be noted that if water temperature conditions are sufficiently low (i.e., ≤ 60°F), spawning activity may begin in September (Moyle 2002).

Fall-run Chinook salmon embryo incubation in the lower Yuba River generally occurs from October through March. The intragravel residence times of incubating eggs and alevins (yolk-sac fry) are highly dependent upon water temperatures.

Fall-run juvenile rearing and outmigration in the lower Yuba River primarily occurs from December through June (CALFED and YCWA 2005; SWRI 2002). Fall-run Chinook salmon fry emergence generally occurs from late-December through March (Moyle 2002). Water temperatures reported to be optimal for rearing of Chinook salmon fry and juveniles are between 45°F and 65°F (NMFS 2002a; Rich 1987; Seymour 1956). Raleigh et al. (Raleigh *et al.* 1986) reviewed the available literature on Chinook salmon thermal requirements and suggested a suitable rearing temperature upper limit of 75°F and a range of approximately 53.6°F to 64.4°F. Zedonis and Newcomb (Zedonis and Newcomb 1997) report that the smoltification process may become compromised at water temperatures above 62.6°F. Fall-run Chinook salmon outmigration generally occurs within several weeks of emergence from gravels. Temperatures required during outmigration are believed to be about the same as those required for successful rearing, as discussed above.

STEELHEAD

Historical information on Central Valley steelhead populations is limited. Steelhead ranged throughout accessible tributaries and headwaters of the Sacramento and San Joaquin Rivers before major dam construction, water development, and other watershed disturbances. Many of the freshwater habitat factors cited for declines in spring-run Chinook salmon runs generally apply to steelhead as well, because of their need for tributaries and headwater streams where cool, well-oxygenated water is available year round. Historical declines in steelhead abundance have been attributed largely to dams that eliminated access to most of their historic spawning and rearing habitat and restricted steelhead to unsuitable habitat below the dams. Other factors that have contributed to the decline of steelhead and other salmonids include habitat modification, over-fishing, disease and predation, inadequate regulatory mechanisms, climate variation, and artificial propagation (NMFS 1996).

CDFG estimated that only approximately 200 steelhead spawned in the lower Yuba River annually before New Bullards Bar Reservoir was completed in 1969. From 1970 to 1979, CDFG annually stocked 27,270–217,378 fingerlings, yearlings, and sub-catchables from Coleman

National Fish Hatchery into the lower Yuba River (CDFG 1991b). Based on angling data, CDFG estimated a run size of 2,000 steelhead in the lower Yuba River in 1975. The current status of this population is unknown, but it appears to be stable and able to support a significant sport fishery (McEwan and Jackson 1996). The Yuba River is managed for natural steelhead production (CDFG 1991b).

The immigration of adult steelhead in the lower Yuba River reportedly occurs from August through March, with peak immigration from October through February (CALFED and YCWA 2005; McEwan and Jackson 1996). Water temperatures can affect the timing of adult spawning and migrations, and can affect the egg viability of holding females. Few studies have been published that examine the effects of water temperature on either immigration or holding, and none have been recent (Bruin and Waldsdorf 1975; McCullough *et al.* 2001). The available studies suggest that adverse effects could occur to immigrating and holding steelhead at water temperatures that exceed the mid 50°F range, and that immigration could be delayed if water temperatures approach approximately 70°F (Bruin and Waldsdorf 1975; McCullough *et al.* 2001).

Steelhead spawning generally occurs from January through April in the lower Yuba River (CALFED and YCWA 2005; CDFG 1991a). Optimal spawning temperatures have been reported to range from 39°F to 52°F (CDFG 1991b). Salmonids typically deposit eggs within a range of depths and velocities that minimize the risk of desiccation as seasonal water levels recede, and that maintain high oxygen levels and remove metabolic wastes from the redd (Spence *et al.* 1996). Water depth range preference for spawning steelhead has been most frequently observed between 0.3 and 4.9 feet (Moyle 2002). The reported preferred water velocity for steelhead spawning is 1.5 feet per second (ft/s) to 2.0 ft/s (USFWS 1995d).

Steelhead embryo incubation generally occurs from January through May in the lower Yuba River (CALFED and YCWA 2005; CDFG 1991a; SWRI 2002). Few studies have been published regarding the effects of water temperature on steelhead spawning and embryo incubation (Redding and Schreck 1979; Rombough 1988). From the available literature, water temperatures in the low 50°F range appear to support high embryo survival, with substantial mortality to eggs reportedly occurring at water temperatures in the high 50°F range and above 60°F (Redding and Schreck 1979; Velsen 1987). Optimal egg incubation temperatures have been reported to range from 48°F to 52°F (CDFG 1991b).

Juvenile steelhead reportedly often rear in the lower Yuba River for one year or more (SWRI 2002). Both seasonal and anthropogenic fluctuations in river flows affect juvenile steelhead habitat quantity and quality. Since 1992, snorkeling, electrofishing, angling surveys have revealed the presence of large numbers of juvenile steelhead/rainbow trout in the lower Yuba River. The presence of a highly acclaimed sport fishery, the lack of direct hatchery influence, and the presence of juveniles representing several age classes confirms that significant natural spawning and rearing occurs in the lower Yuba River. The physical appearance of adults and the presence of seasonal runs and year-round residents suggest that both sea-run (steelhead) and resident rainbow trout exist in the lower Yuba River, although no definitive characteristics have been identified to distinguish young steelhead from resident trout (SWRI *et al.* 2000). The primary rearing habitat for juvenile steelhead/rainbow trout is upstream of Daguerre Point Dam. Juvenile trout (age 0 and 1+) abundances were substantially higher upstream of Daguerre Point Dam, with decreasing abundance downstream of Daguerre Point Dam. Large juveniles and resident trout up to 18 inches long also have been commonly observed in the lower Yuba River upstream and downstream of Daguerre Point Dam (SWRI *et al.* 2000). Within freshwater environments, juvenile salmonids select specific microhabitats where water depth and velocity fall within a specific range or where certain hydraulic properties occur. The reported optimal water velocity for juvenile steelhead is 0.9 ft/s (USFWS 1995d), and juvenile steelhead reportedly most often utilize water depths of approximately 15 inches (McEwan 2001).

In the lower Yuba River, some YOY steelhead are captured in RSTs downstream of Daguerre Point Dam during late-spring and summer, indicating movement downstream. Regardless of whether the downstream moving YOY steelhead will continue to rear within the lower Yuba River or will emigrate out of the river, their thermal requirements are assumed to be the same.

Like other salmonids, growth, survival, and successful smoltification of juvenile steelhead are affected by water temperature. The duration of steelhead residence in freshwater is long relative to that of fall-run Chinook salmon, making the juvenile life stage of steelhead more susceptible to the influences of water temperature, particularly during the over-summer rearing period. The preferred range of water temperatures for juvenile steelhead is reportedly 62.6°F to 68.0°F (Cech and Myrick 1999).

Juvenile steelhead smolt emigration can occur in the lower Yuba River from October through May (CALFED and YCWA 2005; SWRI 2002). River flow may be important in facilitating downstream movement of steelhead smolts. Smolt emigration is prompted by factors (e.g., photoperiod, instream flow, and water temperature), that induce the fish to emigrate once a physiological state of readiness has been achieved (Groot and Margolis 1991). The reported optimum water temperature range for successful smoltification of juvenile steelhead is 44.0°F to 52.3°F (Myrick and Cech 2001; Rich 1987). River flows may be an important factor influencing the rate at which steelhead smolts migrate downstream, although factors influencing the actual speed of migration remain poorly understood.

GREEN STURGEON

During various monitoring activities, only two adult sturgeon (unconfirmed species but believed to be white sturgeon) have been observed in the lower Yuba River (YCWA 2006b). Both were observed milling below Daguerre Point Dam (RM 12) during the 1990s. Although there is a fish ladder at Daguerre Point Dam, it was designed for salmonid passage and it is believed that adult sturgeon are unable to ascend the structure. Since 1999, rotary screw trapping (at Hallwood Boulevard) has been conducted generally between June and September. In addition, a VAKI Riverwatcher system has been operated since July 2003 at the Daguerre Point Dam fish ladders. Sturgeon have not been captured or observed during these recent monitoring activities. However, an observation of an adult sturgeon immediately below Daguerre Point Dam was reported in 2006. Also, two adult sturgeon, one of which has been tentatively identified as a green sturgeon from photographs, were observed by snorkeling immediately below Daguerre Point Dam in 2006 (pers. comm., G. Reedy, SYRCL 2007).

Although there is evidence of spawning by the southern DPS green sturgeon in the lower Sacramento River (Fry 1979), current verification of spawning in tributaries such as the Feather and Yuba rivers does not exist.

AMERICAN SHAD

American shad were introduced into the Sacramento River system in 1871 to provide a recreational and commercial fishery (CDFG 1993); however, a ban was placed on commercial harvest of American shad in 1957 (Moyle 2002). Despite being non-native, American shad are considered an important sport fish in the Central Valley, and are managed accordingly.

The abundance of American shad has not been documented in the lower Yuba River in recent years. The most recent documentation available for American shad populations in the lower Yuba River occurred in 1968 and 1969, in which populations were estimated to range from 30,000 to 40,000 adults (Corps 1977).

According to CDFG (1984), American shad in the upper Sacramento and lower Yuba and American rivers may be swept out of each tributary as eggs or small fish that have not formed an attachment to their home streams. When these un-imprinted American shad return to spawn they do not necessarily enter their natal streams, but may be distributed to tributaries in proportion to the amount of flow from each tributary (CDFG 1984). Also, although homing is generally assumed in the Sacramento River and its tributaries, there is some evidence that numbers of first-time spawning (i.e., "virgin") fish are proportional to flows of each river at the time the American shad arrive (Painter *et al.* 1979). The higher discharge of the Feather River relative to the Yuba River attracts a higher proportion of American shad during spawning migrations. Painter (1979) conducted studies from 1975 through 1978, which showed a positive relationship between increased percentage of Yuba River flow contribution to the Feather River (calculated at Yuba City) and the relative proportion of virgin American shad (i.e., first-time spawners) entering the Yuba River. Although Painter (1979) found a statistically significant relationship, it was based on only three years (1975, 1976, and 1978) of survey data. Furthermore, four years of data (1975-1978) relating Feather River flow (as percent of Feather River plus upper Sacramento River flow) to the percentage of virgin shad in the Feather River run failed to produce such a significant relationship ($r^2 = 0.12$; 1,2 df; $p = 0.50$). These data suggest that factors other than relative instream flow rates also influence the attraction of American shad from mainstem rivers into their associated tributaries.

Differences in water temperature between the Feather and lower Yuba rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. In studies conducted in the Columbia River, it was shown that shad did not enter this river until water temperature reached 60ºF (Leggett and Whitney 1972). Furthermore, it was shown that adult shad have shifted the timing of their spawning immigration into the Columbia River by over a month in response to temporal changes in the temperature profile of this river over the past 50 years (Quinn and Adams 1996).

Data collected on American shad in the lower Yuba River provide additional insight into the influence of flow on shad immigration (YCWA 1990). In 1990, adult American shad were first observed in the Yuba River on May 19 (YCWA 1990). The first American shad appeared in creel surveys conducted that year on May 24th. These findings suggest that few, if any, shad entered the lower Yuba River before flows were increased from 331 cfs on May 15 to 820, 996, and 1,011 on May 16, 17, and 18, respectively. However, it should be noted that there was a concurrent decrease in Feather River flows from 3,200 cfs to 850 cfs during this same period. The events that occurred during May of 1990 may have simply re-allocated shad from the Feather River to the lower Yuba River. Had Feather River flows been maintained, it is possible that the size of the shad run into the Yuba River would have been much lower than was observed that year.

The data discussed above suggest that high spring flows in the lower Yuba River, relative to the lower Feather River, may attract shad into the lower Yuba River that would otherwise spawn elsewhere. Although the number of American shad entering the lower Yuba River to spawn may increase as the Yuba River's flow increases relative to that of the Feather River, no study to date has clearly related high spring flows in the lower Yuba River (or other tributary rivers) to overall Central Valley production of American shad.

American shad require ladders with a lower gradient and water velocity than do anadromous salmonids (Falxa 1994). The fish ladders at Daguerre Point Dam, designed for salmonids, are believed to impede the upstream passage of American shad and, thus, few American shad migrate past Daguerre Point Dam (CALFED and YCWA 2005).

STRIPED BASS

Over the past century, striped bass have become an important commercial and sport fish with high recreational value, and a top predator within the Sacramento-San Joaquin Delta area and upstream rivers. Striped bass are commonly found in the Sacramento River from Princeton (RM 163) downstream to the Delta and in the lower American and Feather rivers. Striped bass can be found in the lower Yuba River downstream of Daguerre Point Dam during spring, corresponding with the spawning period. Striped bass spawn in water temperatures ranging from 59°F to 68°F (Moyle 2002). Late spring and early summer water temperatures in the lower Yuba River appear to be suitable for striped bass spawning. However, CDFG monthly RST data from 1999 through 2006 have not recovered striped bass larvae or eggs in the lower Yuba River, suggesting that striped bass may use the river primarily for feeding. Striped bass are not known to migrate past Daguerre Point Dam (CDFG 1991a).

10.1.3 CVP/SWP UPSTREAM OF THE DELTA REGION

10.1.3.1 FEATHER RIVER BASIN

The Feather River study area includes the Oroville Facilities, including Oroville Reservoir, the Thermalito Forebay, the Thermalito Afterbay, the Feather River Fish Hatchery, and the lower Feather River extending from the Fish Barrier Dam to the confluence with the Sacramento River. Details regarding the facilities and water bodies associated with the Feather River and the fisheries resources they support are provided below.

OROVILLE RESERVOIR

Oroville Reservoir is located at the confluence of the West Branch and the North, Middle, and South Forks of the Feather River, upstream from the Yuba and Bear River tributaries, at an elevation of 900 feet above msl. Oroville Reservoir is the second largest reservoir in California, with a storage capacity of 3.5 MAF. Like many other California foothill reservoirs, Oroville Reservoir is steep-sided, with large surface-elevation fluctuations and a low surface-to-volume ratio. It is a warm, monomictic reservoir that thermally stratifies in the spring, destratifies in the fall, and remains destratified throughout the winter. Due to the stratification, Oroville Reservoir has been said to contain a "two-story" fishery, supporting both coldwater and warmwater fisheries that are thermally segregated for most of the year. Once Oroville Reservoir destratifies in the fall, the two fishery components mix in their habitat utilization.

Oroville Reservoir's coldwater fishery is primarily composed of coho salmon and brown trout, although rainbow trout and lake trout are periodically caught. The coldwater fisheries for coho salmon and brown trout are sustained by hatchery stocking because natural recruitment to the Oroville Reservoir coldwater fishery is very low. A "put-and-grow" hatchery program is currently in use, where salmonids are raised at CDFG hatcheries and stocked in the reservoir as juveniles, with the intent that these fish will grow in the reservoir before being caught by anglers (DWR 2001).

The Oroville Reservoir's warm-water fishery is a regionally important self-sustaining fishery and supports both centrarchids and ictalurids. The black bass fishery is the most significant, both in terms of angler effort and economic impact on the area. Spotted bass are the most abundant bass species in Oroville Reservoir, followed by largemouth, redeye and smallmouth bass, respectively. Catfish are the next most popular warmwater fish at Oroville Reservoir, with both channel and white catfish present in the lake. White and black crappie are also found in Oroville Reservoir, though populations fluctuate widely from year to year. Bluegill and green sunfish are the two primary sunfish species in Oroville Reservoir, though red ear sunfish and warmouth are also present in very low numbers. Although common carp are considered by many to be a nuisance species, they are also abundant in Oroville Reservoir (DWR 2001). The primary forage fish in Oroville Reservoir are wakasagi and threadfin shad. Threadfin shad were intentionally introduced in 1967 to provide forage for gamefish, whereas the wakasagi migrated down from an upstream reservoir in the mid-1970s (DWR 2001).

LOWER FEATHER RIVER

The lower Feather River commences at the Low Flow Channel, which extends eight miles from the Fish Barrier Dam (RM 67) to the Thermalito Afterbay Outlet (RM 59). Under an agreement with the CDFG, flows in this reach of the river are regulated at 600 cfs, except during flood events when flows have been as high as 150,000 cfs (DWR 1983). Average monthly water temperatures typically range from about 47°F in winter to about 65°F in summer. The majority of the Low Flow Channel flows through a single channel contained by stabilized levees. Side-channel or secondary channel habitat is extremely limited, occurring primarily in the Steep Riffle and Eye Riffle areas between RM 60-61. The channel banks and streambed consist of armored cobble as a result of periodic flood flows and the absence of gravel recruitment. However, there are nine major riffles with suitable spawning size gravel, and approximately 75 percent of the Chinook salmon spawning takes place in this upper reach (Sommer *et al.* 2001). Releases are made from the coldwater pool in Oroville Reservoir and this cold water generally provides suitable water temperatures for spawning in the Low Flow Channel (DWR 2001).

The lower reach extends 15 miles from the Thermalito Afterbay Outlet (RM 59) to Honcut Creek (RM 44). Releases from the outlet vary according to operational requirements. In a normal year, total flow in the lower reach ranges from 1,750 cfs in fall to 5,000-8,000 cfs in spring. Water temperature in winter is similar to the Low Flow Channel but increases to 74°F in summer. Higher flows dramatically increase the channel width in this reach. Numerous mid-channel bars and islands braid the river channel, creating side-channel and backwater habitat. The channel is not as heavily armored and long sections of riverbanks are actively eroding. In comparison to the Low Flow Channel, there is a greater amount of available spawning areas, which are isolated by longer and deeper pools (DWR 2001).

The lower Feather River from the Thermalito Afterbay Outlet to Honcut Creek supports a variety of anadromous and resident fish species. The most important fish species in terms of sport fishing is the fall-run Chinook salmon. Approximately 75 percent of the natural spawning for fall-run Chinook salmon currently occurs between the Fish Barrier Dam and the Thermalito Afterbay Outlet (RM 67-59), with approximately 25 percent of the spawning occurring between the Afterbay outlet and Honcut Creek (RM 59-44) (Sommer *et al*. 2001). The fall-run may enter the river as early as July (DWR 1982; Moyle 2002; NMFS 1999; Sommer *et al*. 2001) and begin spawning in September (DWR 2004d). Adult immigration and holding generally lasts until December (DWR 1982; Moyle 2002; NMFS 1999; Sommer *et al*. 2001), while spawning activity and embryo incubation typically continues through February, with October and November constituting the peak spawning months (DWR 2004d; Moyle 2002). Fall-run Chinook salmon juvenile rearing and downstream movement in the Feather River generally occurs from November through June (Seesholtz *et al.* 2003; Vogel and Marine 1991).

In the Feather River, spring-run Chinook salmon spawning may occur a few weeks earlier than fall-run spawning, but currently there is no clear distinction between the two, because of the disruption of spatial segregation by Oroville Dam. Thus, the spawning and embryo incubation life stage of spring-run Chinook salmon in the Feather River generally occurs during the same months (i.e., September through February) as fall-run Chinook salmon spawning and embryo incubation (DWR 2004d; Moyle 2002). Fish exhibiting the typical life history of the spring-run are found holding at the Thermalito Afterbay Outlet and the Fish Barrier Dam as early as March (DWR 2004d). Spring-run Chinook salmon juveniles reportedly rear in their natal streams for up to 15 months (Moyle 2002).

Adult steelhead typically ascend the Feather River from September through April (Busby *et al.* 1996; pers. comm., Cavallo 2004; McEwan 2001; Moyle 2002), where spawning takes place rather quickly. The majority of the steelhead spawning and embryo incubation life stage in the Feather River generally lasts from December through May (Busby *et al.* 1996; pers. comm., Cavallo 2004; McEwan 2001; Moyle 2002). The residence time of adult steelhead in the Feather River after spawning and the extent of adult steelhead post-spawning mortality is currently unknown. It appears that most of the natural steelhead spawning in the Feather River occurs in the Low Flow Channel, particularly in the upper reaches near Hatchery Ditch. It is unknown whether steelhead spawn below the Thermalito Afterbay Outlet. However, based on the spawning habitat available it is very likely that at least some steelhead spawn below the Afterbay outlet. Soon after emerging from the gravel, a small percentage of the fry appear to emigrate. The remainder of the population rears in the river for at least six months to one year (McEwan 2001; Moyle 2002), then reportedly emigrate from January through June (pers. comm., Cavallo 2004). Recent studies have confirmed that juvenile rearing (and probably adult spawning) is most concentrated in small secondary channels within the Low Flow Channel. The smaller substrate size and greater amount of cover (compared to the main river channel) likely make these side channels more suitable for steelhead spawning. Currently, this type of habitat comprises less than 1 percent of the available habitat in the Low Flow Channel (DWR 2000).

Green sturgeon adults have been observed periodically in small numbers in the Feather River (NMFS Website 2005). According to NMFS, at least two records of adult green sturgeon have been confirmed in 2004 in the lower Feather River (NMFS Website 2005). In fact, NMFS has stated in their *Proposed Threatened Status for the Southern Distinct Population Segment of North American Green Sturgeon* that, although nonspecific and unconfirmed, there are reports that green sturgeon may reproduce in the Feather River during high flow years (NMFS Website 2005). The occasional capture of larval green sturgeon in outmigrant traps suggests that green sturgeon spawn in the Feather River (Moyle 2002).

American shad and striped bass are also common targets for anglers. The American shad adult immigration and spawning life stage in the Sacramento River system generally occurs from April through June (Moyle 2002). Striped bass (*Morone saxatilis*) is an introduced game fish that frequents the lower Feather River in April through June for spawning (Bell 1991; Hassler 1988; Hill *et al.* 1989; Moyle 2002). Striped bass have been reported in Thermalito Forebay (DWR 2003a), which may indicate a small landlocked breeding population.

Other than incidental observations of splittail in the Feather River (Seesholtz *et al.* 2003; USFWS 1995b), there have been no directed studies of abundance in this area. Because splittail have been observed in the Feather River, it is assumed that some spawning takes place. Juvenile splittail begin appearing at Delta salvage pumps in April and peak during late April and May, suggesting that most juvenile out-migration from the Feather River has occurred by the end of May (Daniels and Moyle 1983; Sommer Unpublished Work).

10.1.3.2 SACRAMENTO RIVER BASIN

The Sacramento River study area includes the Sacramento River from the Feather River confluence down to the Delta. Details regarding the water bodies associated with the Sacramento River and the fisheries resources they support are provided below.

SACRAMENTO RIVER

The upper Sacramento River is often defined as the portion of the river from Princeton (RM 163) (the downstream extent of salmonid spawning in the Sacramento River (Water Forum 1999) to Keswick Dam (the upstream extent of anadromous fish migration and spawning). The upper Sacramento River provides a diversity of aquatic habitats, including fast-water riffles and shallow glides, slow-water deep glides and pools, and off-channel backwater habitats. Consequently, this section of the river is of primary importance to native anadromous species, and is presently utilized for spawning and early-life-stage rearing, to some degree, by all four runs of Chinook salmon (fall, late-fall, winter, and spring runs) and steelhead.

The lower Sacramento River is generally defined as the portion of the river from Princeton to the Delta at approximately Chipps Island (near Pittsburg), which includes the study area for this project. The lower Sacramento River is predominantly channelized, leveed and bordered by agricultural lands. Aquatic habitat in the lower Sacramento River is characterized primarily by slow-water glides and pools, is depositional in nature, and has lower water clarity and habitat diversity, relative to the upper portion of the river.

Many of the fish species utilizing the upper Sacramento River also use the lower river to some degree, even if only as a migratory pathway to and from upstream spawning and rearing grounds. For example, adult Chinook salmon and steelhead primarily use the lower Sacramento River as an immigration route to upstream spawning habitats and an emigration route to the Delta. The lower river also is used by other fish species (e.g., Sacramento splittail and striped bass) that make little to no use of the upper river (upstream of RM 163). Overall, fish species composition in the lower portion of the Sacramento River is quite similar to that of the upper Sacramento River and includes resident and anadromous cold- and warmwater species. Many fish species that spawn in the Sacramento River and its tributaries depend on river flows to carry their larval and juvenile life stages to downstream nursery habitats. Native and introduced warmwater fish species primarily use the lower river for spawning and rearing, with juvenile anadromous fish species also using the lower river and non-natal tributaries, to some degree, for rearing.

An important component of aquatic habitat throughout the Sacramento River is referred to as Shaded Riverine Aquatic cover. Shaded Riverine Aquatic cover consists of the portion of the riparian community that directly overhangs or is submerged in the river. Shaded Riverine Aquatic cover provides high-value feeding and resting areas and escape cover for juvenile anadromous and resident fishes. Shaded Riverine Aquatic cover also can provide some degree of local temperature moderation during summer months due to the shading it provides to nearshore habitats (USFWS 1980). The importance of Shaded Riverine Aquatic cover to Chinook salmon was demonstrated in studies conducted by the USFWS (DeHaven 1989). In early summer, juvenile Chinook salmon were found exclusively in areas of Shaded Riverine Aquatic cover, and none were found in nearby rip-rapped areas (DeHaven 1989).

Over 30 species of fish are known to use the Sacramento River. Of these, a number of both native and introduced species are anadromous. Anadromous species include Chinook salmon, steelhead, green and white sturgeon, striped bass and American shad. The majority of adult immigration into the Sacramento River and the subsequent period of holding reportedly occurs from December through July for winter-run Chinook salmon (Moyle 2002; USFWS 1995a), from February through September for spring-run Chinook salmon (CDFG 1998; Lindley *et al.* 2004; Moyle 2002) from July through December for fall-run Chinook salmon (NMFS 2004; Snider *et al.* 1999; Vogel and Marine 1991), from October through April for late fall-run Chinook salmon (Moyle 2002), and from August through March for steelhead (McEwan 2001; NMFS 2004). Most winter-run sized Chinook salmon fry and juveniles collected in an RST located at RM 205 are captured from July through April (pers. comm., Coulon 2004); however, NMFS (1993; NMFS 1997) report juvenile rearing and outmigration extending from June through April. CDFG (1998) and Moyle (2002) report that spring-run Chinook salmon juveniles rear and move downstream year-round in the Sacramento River. Moyle (2002) and Vogel and Marine (1991) report that the majority of the juvenile rearing and downstream movement life stage occurs from December through June for fall-run Chinook salmon and from April through December for late fall-run Chinook salmon. McEwan (2001)reports that steelhead fry and fingerlings rear and move downstream in the Sacramento River year-round. Most steelhead smolts reportedly emigrate from January through June (McEwan 2001; Newcomb and Coon 2001; Snider and Titus 2000a; USFWS 1995a). Steelhead smolts reportedly emigrate from the Yuba River from October through May (CALFED and YCWA 2005). Steelhead smolts emigrating from the Yuba River are presumably migrating through the Feather and Sacramento rivers to more saline environs in the Bay/Delta. Thus, the steelhead smolt emigration in the Sacramento River may begin in October. Other Sacramento River fishes are considered resident species, which complete their lifecycles entirely within freshwater, often in a localized area. Resident species include rainbow and brown trout, largemouth and smallmouth bass, channel catfish, sculpin, Sacramento pikeminnow, Sacramento sucker, hardhead, and common carp (Moyle 2002).

The Southern DPS of green sturgeon consists of coastal and Central Valley populations south of the Eel River, with the Sacramento River containing the only known spawning population (71 FR 17757 (April 7, 2006)). There is evidence that the Southern DPS of green sturgeon continues to spawn in the Sacramento River and that suitable spawning habitat still exists there. The best available data suggest that Southern DPS adults and juveniles have consistently occurred within the Sacramento River system over a relatively long time period (71 FR 17757 (April 7, 2006)).

Despite being non-native, American shad are considered an important sport fish in the Central Valley, and are managed accordingly. Therefore, the American shad immigration and spawning life stage in the Sacramento River will be evaluated for potential impacts associated with changes in flow and water temperature under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative.

Adult striped bass are present in the Sacramento River throughout the year, with peak abundance occurring during the spring months (i.e., April, May, and June) (CDFG 1971; DeHaven 1979; DeHaven 1977). In the Sacramento River, most striped bass spawning is believed to occur between Colusa and the mouth of the Feather River. Because substantial striped bass spawning, embryo incubation, and initial rearing occurs in the Sacramento River, potential impacts to these fish associated with potential changes in flow and water temperature under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative will be evaluated.

The Yolo and Sutter bypasses, floodwater bypasses from the Sacramento River, serve as important Sacramento splittail spawning and early rearing habitat (Sommer *et al*. 1997). Sacramento splittail spawning can occur anytime between late February and early July but peak spawning occurs in March and April (Moyle 2002). A gradual upstream migration begins in the winter months to forage and spawn, although some spawning activity has been observed in Suisun Marsh (Moyle 2002). Eggs normally incubate for three to seven days depending on water temperature (Moyle 2002). After hatching, splittail larvae remain in shallow weedy areas until water recedes, and they migrate downstream (Meng and Moyle 1995). Downstream movement of juvenile splittail appears to coincide with drainage from the floodplains between May and July (Caywood 1974; Meng and Moyle 1995; Sommer *et al*. 1997). Because splittail spawning and rearing occurs in the Sacramento River, potential impacts to these fish associated with potential changes in flow and water temperature under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative will be evaluated.

10.1.4 DELTA REGION

The San Francisco Bay/Sacramento-San Joaquin Delta makes up the largest estuary on the west coast of the United States (EPA 1992). The Sacramento-San Joaquin Delta, the most upstream portion of the Bay-Delta estuary, is a triangle-shaped area composed of islands, river channels, and sloughs at the confluence of the Sacramento and San Joaquin rivers. The northern Delta is dominated by the waters of the Sacramento River, which are of relatively low salinity; whereas the relatively higher salinity waters of the San Joaquin River dominate the southern Delta. The central Delta includes many channels where waters from the Sacramento and San Joaquin rivers and their tributaries converge. The Delta includes the river channels and sloughs at the confluence of the Sacramento and San Joaquin rivers.

The Delta's tidally influenced channels and sloughs cover a surface area of approximately 75 square miles. Data suggest that these intertidal waters favor a number of resident freshwater fish and invertebrate species at the deepest, most subsided sites. Marsh plains and tidal channels formed within these intertidal regions continuously drain and fill with the ocean tide allowing movement of fishes, in addition to primary and secondary production, inshore and offshore. Tidal action may therefore be important for pelagic organisms as inundation allows increased foraging success and opportunity resulting from the larger abundance of phytoplankton and zooplankton inshore. Intertidal habitats may also provide reduced predation for young fishes (Brown 2003). These waters may also be used as migration corridors and rearing areas for anadromous fish species and as spawning and rearing grounds for many estuarine species. Similarly to intertidal regions, shallow-water habitats, defined as areas that are less than three meters in depth (mean low water), are considered particularly important forage, reproduction, rearing, and refuge areas for numerous fish and invertebrate species.

The Bay-Delta estuary provides habitat for a diverse assemblage of fish and macroinvertebrates. Many of the fish and macroinvertebrate species inhabit the estuary year-round, while other species inhabit the system on a seasonal basis as a migratory corridor between upstream freshwater riverine habitat and coastal marine waters, as seasonal foraging habitat, or for reproduction and juvenile rearing.

There have been over 100 documented introductions of exotic species to the Bay-Delta estuary. These include intentionally introduced game fishes such as striped bass and American shad, and inadvertent introductions of undesirable organisms such as the Asian and Asiatic clams. **Table 10-3.** presents common and scientific names for all known native and exotic fish species found in the Delta, including species no longer present.

Table 10-3. Fishes of the Sacramento-San Joaquin Delta

Common Name	Scientific Name	Life History	Status
Pacific lamprey*	*Lampetra tridentata*	A	Declining
River lamprey*	*Lampetra ayresi*	A	SC
White sturgeon*	*Acipenser transmontanus*	A	Declining; fishery
Green sturgeon*	*Acipenser medirostris*	A	SC; FT
American shad	*Alosa sapidissima*	A	Fishery
Threadfin shad	*Dorosoma petenense*	A	Common
Steelhead*	*Oncorhynchus mykiss*	A	SC; FT; fishery
Brown Trout	*Salmo trutta*	R	Non-native
Chum salmon*	*Oncorhynchus keta*	A	SC; rare
Kokanee salmon	*Oncorhynchus nerka*	R	Non-native
Chinook salmon*	*Oncorhynchus tshawytscha*	A	Fishery
Sacramento fall-run			Fishery
late fall-run			SC
winter-run			FE, SE
spring-run			ST; FT
Longfin smelt*	*Spirinchus thaleichthys*	A-R	SC
Delta smelt*	*Hypomesus transpacificus*	R	FT, ST
Wakasagi	*Hypomesus nipponensis*	R?	Invading
Hitch*	*Lavinia exilicauda*	R	Unknown
Sacramento blackfish*	*Orthodon microlepidotus*	R	Unknown
Sacramento splittail*	*Pogonichthys macrolepidotus*	R	SC
Hardhead*	*Mylopharodon conocephalus*	N	SC
Speckled dace	*Rhinichthys osculus*	R	SC
California roach	*Lavinia symmetricus*	R	SC
Sacramento pikeminnow*	*Ptychocheilus grandis*	R	Common
Fathead minnow	*Pimephales promelas*	N	Rare
Golden shiner	*Notemigonus crysoleucas*	R?	Uncommon
Common carp	*Cyprinus carpio*	R	Common
Goldfish	*Carassius auratus*	R	Uncommon
Sacramento sucker*	*Catostomus occidentalis*	R	Common
Black bullhead	*Ameiurus melas*	R	Common
Brown bullhead	*Ameiurus nebulosus*	R	Uncommon
White catfish	*Ameiurus catus*	R	Abundant
Channel catfish	*Ictalurus punctatus*	R	Common
Western mosquitofish	*Gambusia affinis*	R	Abundant
Striped bass	*Morone saxatilis*	R-A	Abundant
Inland silverside	*Menidia beryllina*	R	Abundant
Sacramento perch*	*Archoplites interruptus*	N	SC
Bluegill	*Lepomis macrochirus*	R	Common
Redear sunfish	*Lepomis microlophus*	R	Uncommon
Green sunfish	*Lepomis cyanellus*	R	Uncommon
Warmouth	*Lepomis gulosus*	R	Uncommon
White crappie	*Pomoxis annularis*	R	Common
Black crappie	*Pomoxis nigromaculatus*	R	Uncommon
Largemouth bass	*Micropterus salmoides*	R	Common
Smallmouth bass	*Micropterus dolomieu*	R	Uncommon
Redeye bass	*Micropterus coosae*	R	Non-native
Spotted Bass	*Micropterus punctulatus*	R	Non-native
Bigscale logperch	*Percina macrolepida*	R	Common
Yellow perch	*Perca flavescens*	N	Rare
Tule perch*	*Hysterocarpus traski*	R	Common

Common Name	Scientific Name	Life History	Status
Threespine stickleback*	*Gasterosteus aculeatus*	R	Common
Yellowfin goby	*Acanthogobius flavimanus*	R	Common
Chameleon goby	*Tridentiger trigonocephalus*	R	Invading
Staghorn sculpin*	*Leptocottus armatus*	M	Common
Prickly sculpin*	*Cottus asper*	R	Abundant
Starry flounder*	*Platichthys stellatus*	M	Common

Source: Modified from (USFWS, 1994 *as cited in SDIP (Reclamation and DWR 2005)*
An asterisk (*) indicates a native species; A = anadromous; R = resident; N = non-resident visitor; M = marine; SC = species of special concern; FT = Federal threatened; ST = State threatened; FE = Federal endangered; SE = State endangered; FP = Federal proposed; FC = Federal candidate.

Migratory (e.g., anadromous) fish species which inhabit the Bay-Delta system and its tributaries include, but are not limited to, white sturgeon, green sturgeon, Chinook salmon (including fall-run, spring-run, winter-run, and late-fall-run Chinook salmon), steelhead, American shad, Pacific lamprey and river lamprey (Moyle 2002). The Bay-Delta estuary and tributaries also support a diverse community of resident fish which includes, but is not limited to, Sacramento sucker, prickly and riffle sculpin, California roach, hardhead, hitch, Sacramento blackfish, Sacramento pikeminnow, speckled dace, Sacramento splittail, tule perch, inland silverside, black crappie, bluegill, green sunfish, largemouth bass, smallmouth bass, white crappie, threadfin shad, carp, golden shiner, black and brown bullhead, channel catfish, white catfish, and a variety of other species which inhabit the more estuarine and freshwater portions of the Bay-Delta system (Moyle 2002).

The geographic distribution of species within the estuary is determined, in part, by salinity gradients, which range from freshwater within the Sacramento and San Joaquin River systems to marine conditions near the Golden Gate Bridge. The abundance, distribution, and habitat use by these fish and macroinvertebrates has been monitored over a number of years through investigations conducted by CDFG, NMFS, USFWS, Reclamation, and several other investigators. Results of these monitoring programs have shown changes in species composition and abundance within the system over the past several decades. Many of the fish and macroinvertebrate species have experienced generally declining trends in abundance (Moyle *et al.* 1995) with several native species, including winter-run and spring-run Chinook salmon, steelhead, and delta smelt either listed or being considered for listing under the federal or CESA. A number of fish and macroinvertebrate species inhabiting the estuary also support recreational and commercial fisheries, such as fall-run Chinook salmon, Bay shrimp, Pacific herring, northern anchovy, starry flounder, striped bass, largemouth bass, sturgeon, and many others, and hence the estuary also has been identified as essential fish habitat (EFH) for these species.

Many factors have contributed to the decline of fish species within the Delta (Moyle *et al.* 1995), including changes in hydrologic patterns resulting from water project operations, loss of habitat, contaminant input, entrainment in diversions, and introduction of non-native species. The Delta is a network of channels through which water, nutrients, and aquatic food resources are moved and mixed by tidal action. Pumps and siphons divert water for Delta irrigation and municipal and industrial use or into CVP and SWP canals. River inflow, Delta Cross Channel operations, and diversions (including agricultural and municipal diversions and export pumping) affect Delta species through changes in habitat conditions (e.g., salinity intrusion), and mortality attributable to entrainment in diversions.

The majority of land in the Delta, which covers approximately 678,200 acres, is irrigated cropland (CALFED 2000). Other terrestrial habitats include *"riparian vegetation, wetlands, and other forms of 'idle land'"* (CALFED 2000). The CALFED PEIS/EIR describes the Delta aquatic environment as comprised of *"…channels, sloughs, and other open water. Under CEQA Existing Condition, most of the open water is deep-channel habitat that has been modified to provide passage for ocean-going vessels as well as efficient conveyance of fresh water from the Sacramento River through the Delta. Vegetation is removed from levees, primarily to facilitate inspection, repair, and flood fighting when necessary. Although current flood protection programs may allow for properly managed vegetation, the amount of shallow water and shaded riverine habitat throughout the Delta is much lower now than it was historically, largely having been replaced by a patchwork of agricultural islands and revetted levees"* (CALFED 2000).

Seasonal and interannual variability in hydrologic conditions, including the magnitude of flows into the Bay-Delta estuary from the Sacramento and San Joaquin rivers and other tributaries and the outflow from the Delta into San Francisco Bay, have been identified as important factors affecting habitat quality and availability, and abundance for a number of fish and invertebrate species within the Bay-Delta estuary. Flows within the Bay-Delta system may affect larval and juvenile transport and dispersal, water temperatures (primarily within the upstream tributaries), dissolved oxygen concentrations (e.g., during the fall within the lower San Joaquin River), and salinity gradients within the estuary. The seasonal timing and geographic location of salinity gradients are thought to be important factors affecting habitat quality and availability for a number of species (Baxter *et al.* 1999). Operation of upstream storage impoundments, in combination with natural hydrologic conditions, affects seasonal patterns in the distribution of salinity within the system. Water project operations, for example, may result in a reduction in Delta inflows during the late winter and spring with an increase in Delta inflows, when compared to historical conditions, during the summer months. Objectives have been established for the location of salinity gradients during the late winter and spring to support estuarine habitat for a number of species (X2 location), in addition to other salinity criteria for municipal, agricultural, and wetland benefits. Although a number of studies have focused on the effects of variation in salinity gradients as a factor affecting estuarine habitat during the late winter and spring (Kimmerer 2002), very little information exists on the effects of increased inflows into the Delta during summer months and the resulting changes in salinity conditions (e.g., reduced salinity when compared to historical conditions) on the abundance, growth, survival, and distribution of various fish and macroinvertebrates inhabiting the Bay-Delta system.

10.1.4.1 RECENT DECLINE OF PELAGIC FISH SPECIES IN THE DELTA

In January 2005, DWR and CDFG biologists identified and reported a marked decline in pelagic (i.e., open-water) fish species in the Delta. Between 2002 and 2004, the Interagency Ecological Program (IEP) observed record low abundances for delta smelt and striped bass, and near record lows for longfin shad and threadfin shad (IEP 2007). In addition to the declining fish abundance, IEP also observed declining levels of zooplankton. During this time period, winter-spring river flows into the San Francisco Estuary were moderate and, therefore, were expected to support modest production. However, in 2005, favorable hydrology did not improve fish abundance as expected. During this time there was no evidence suggesting a major loss in suitable habitat or apparent growth rates for delta smelt and longfin shad (IEP 2007).

A draft white paper discussing the findings was distributed among IEP agencies and a work plan was developed to begin intensive data analysis and technical studies into the causes of the decline. Information regarding pelagic organism declines can be found in the letter from DWR, CDFG, Reclamation, and USFWS to Congressman Miller with Enclosure 1, "*Interagency Ecological Program 2005 Workplan to Evaluate the Decline of Pelagic Species in the Upper San*

Francisco Estuary." The IEP agencies agreed to provide approximately $2 million to support these initial studies, although, the 2007 cost estimate was increased to approximately $3.7 million. This work plan was updated in January 2007 to reflect more recent studies and thus to refine the existing conceptual models for selected fish and zooplankton. The work plan is designed to explore historical data to clarify the nature of the decline and to preliminarily screen possible explanations for the decline from three broad categories: (1) ecological effects of non-indigenous species introductions; (2) unexpected effects of recent changes in water project operations; and (3) toxic effects of agricultural chemicals and blue-green algae. Although the updated 2007 work plan is intended to improve upon and refine various components of the conceptual modeling approach, the IEP recognizes the numerous limitations still present in the study. The correct explanation may be simple, or it may involve a combination of factors. As part of these investigations, there are currently about 45 studies and monitoring programs underway to determine possible causes of the pelagic organism decline (POD).

In June 2006, the California state legislature directed the Resources Agency to report on proposed actions to address the POD and stabilize the ecosystem in the Delta (DWR and CDFG 2007). In response to this request, the Resources Agency, DWR, and CDFG issued the Pelagic Fish Action Plan in March 2007. The Pelagic Fish Action Plan expanded upon the findings of the 2005 Delta Smelt Action Plan[3], and identified several proposed actions designed to address the POD that were based on the availability of more recent information and considered actions suggested by the Delta Smelt Working Group, the State Water Contractors, environmental groups and others. The new recommended actions will be scientifically evaluated and peer-reviewed through existing CALFED and IEP processes, and will be guided by the results of the ongoing POD studies. Thus, these collaborative efforts will allow for better sharing of current scientific information and a more accurate and comprehensive approach to improving Delta ecosystem health for pelagic fish species (DWR and CDFG 2007).

The following is a summary of the suite of actions evaluated by the 2007 Pelagic Fish Action Plan, which are proposed for implementation to help stabilize the Delta ecosystem and improve conditions for pelagic fish species:

- ***Comprehensive Ecosystem Evaluation Actions:*** (1) Re-initiation of formal Section 7 consultation with NMFS and USFWS on the long-term coordinated operations of the CVP and the SWP; and (2) Development of the Bay-Delta Conservation Plan, in which CDFG will initiate planning agreements with participants under the Natural Community Conservation Planning Act to define goals, conservation objectives, and a list of natural communities and endangered, threatened, candidate or other species that occur, or have occurred, in the Delta planning area.
- ***Water Project Operation Actions:*** (1) Minimize net upstream flows in Old and Middle rivers from January through February 15th to 3,500 cfs, or 3,500 to 5,000 cfs (winter/early spring); (2) Maintain net downstream flows in Old and Middle rivers prior to the VAMP period (early/late spring); (3) No South Delta barriers during VAMP and until June 1 (late spring); and (4) Maintain X2 west of Collinsville during May through December in wetter years (summer/fall)

[3] In October 2005, the Resources Agency released the Delta Smelt Action Plan, which was a compilation of scientific research activities and studies to identify and understand the causes of the POD, and to identify other actions to benefit the species.

- ***Food Web Actions***: (1) Provide flows through the Yolo Bypass into Cache Slough (summer); (2) Manage flooding in north Delta for seasonal floodplain habitat; and (3) Sherman Island floodplain phytoplankton pilot project to increase primary production
- ***Habitat Improvement Actions:*** (1) Restore tidal action to the Suisun Marsh, Blacklock Restoration Project; (2) Restore tidal action to the Suisun March, Meins Landing Project; and (3) Dutch Slough Tidal Restoration Project
- ***Contaminants Management Actions:*** (1) Encourage greater enforcement of the California Water Code and the Clean Water Act for control of pyrethroids and other contaminants
- ***Invasive Species Actions***: (1) Increase staffing at agricultural inspection stations to inspect watercraft for zebra mussels and other invasive species; and (2) Ballast water control
- ***Other Actions***: (1) Fund delta smelt culture lab; (2) Develop delta smelt refuge population; and (3) Assess and reduce power plant entrainment

The actions listed above can be categorized into one of three areas related to the conceptual model of the POD study (i.e., toxins, invasive species and water project operations). Several actions are currently being implemented and others are being evaluated for future implementation. The next "synthesis" report is scheduled for December 2007, and will be prepared by DWR and CDFG in collaboration with the National Center for Ecological Analysis and Synthesis at U.C. Santa Barbara. Information and new findings will be made available to agency directors as they become available over the next two years (DWR and CDFG 2007).

Related to the actions listed above, the Delta Smelt Working Group decided to moderate the flows in Old and Middle Rivers earlier this year. As of January 2007, DWR and Reclamation managed SWP and CVP water operations, respectively, to maintain the combined upstream flow of Old and Middle rivers between 3,500 and 5,000 cfs (WWWCO website). The 2007 VAMP period began on April 22nd with a target flow of 3,200 cfs on the San Joaquin River at Vernalis, and a combined export rate of 1,500 cfs (WWWCO website). As described in DWR and CDFG (2007), …"*recent analysis has shown that salvage of adult delta smelt is very low or zero during years when Old River and Middle River flows are positive (i.e., away from the export facilities). The underlying mechanism between the relationship is that delta smelt are less vulnerable to entrainment and subsequent salvage when less water is being drawn into the central Delta to the south when suitable habitat for spawning is found farther away from the export diversions*." Conversely, DWR and CDFG (2007) also states "*…This action has a high degree of scientific uncertainty because the relationship between net flow in Old and Middle Rivers and adult delta smelt salvage may not be linear. Average flow for the two months may not be the best predictor of salvage; antecedent conditions and events over shorter time periods in January and February may determine the outcome*." Thus, although the results of this experimental action are believed to be beneficial, new information may arise before January 2008 and prove otherwise, and further study is required to determine whether or not it will be deemed necessary in light of other changes to CVP/SWP operations in the Delta that are likely to occur in the years to come. However, in consideration of the importance of the POD and Delta conditions overall, the actions on combined Old and Middle rivers flows are recognized as a current management tool.

Because the Old and Middle river actions that were implemented in 2007 are still preliminary and experimental, they are not used as an impact indicator or significance criterion in this EIR/EIS. Depending on the outcome of other POD studies, these actions may be further refined or replaced if new information becomes available that indicates significant relationships between POD and these, or other explanatory variables. Nonetheless, for this EIR/EIS a sensitivity analysis was conducted to compare combined Old and Middle River flows during January through June, consistent with the Pelagic Fish Action Plan and current existing condition considerations. Combined Old and Middle River flows by long-term average and average by water year type for these months were used in the sensitivity analysis for the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition. The equation used to perform these calculations is a linear regression based on CALSIM inputs of combined exports at Banks and Jones pumping plants and San Joaquin River flow at Vernalis. Model results for all months are presented in **Appendix F6**.

Sensitivity analyses results indicate that long-term average reverse flows slightly (0.2 percent) increase during January and February, do not change during April, and decrease by 0.9 percent, 2.5 percent, and 1.1 percent during March, May and June, respectively. During January, slight (0.1 percent, 0.5 percent, and 0.4 percent) increases in reverse flows occur under wet, dry and critical water years, respectively, and do not change during above normal and below normal water years. February exhibits a similar pattern, with no change in the magnitude of reverse flows during wet, above normal and below normal water years, with slight (0.3 and 0.4 percent) increases in reverse flows during dry and critical water years.

From March through May, reverse flows either do not change or are reduced in magnitude under all water year types under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition. During March, reverse flows decrease (1.5 percent and 1.9 percent) under wet and dry water years, and do not change in above normal, below normal and critical water years. During April, reverse flows do not change under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition under any water year type. During May, reverse flows decrease 5.8 percent during dry water years, and do not change during other water year types. During June, reverse flows decrease in magnitude during all water year types, ranging from a 0.5 percent decrease during critical water years to a 1.9 percent decrease during above normal water years.

To date, the 2007 20-mm survey for juvenile delta smelt has collected record low numbers of juvenile delta smelt. After the fifth of eight surveys, only 25 individuals had been collected, about 7.7 percent of the 326 taken to this point in 2006, and only 7.1 percent of the 2000-2006 average of 353 (DSWG 2007). Coupled with these survey results, the first salvage of delta smelt juveniles were observed at the federal water export facility on May 11, 2007. Similarly, entrainment of juvenile delta smelt was observed at the state water export facility between May 25, 2007 and May 31, 2007. The detection of delta smelt at the CVP/SWP salvage facilities created a very high degree of concern because, for an annual species such as delta smelt, failure to recruit a new year-class is an urgent indicator that the species has become critically imperiled and an emergency response is warranted (DSWG 2007). The combination of these findings prompted DWR to temporarily stop pumping at the SWP Banks Pumping Plant and Reclamation to maintain pumping at the CVP Jones Pumping Plant at a rate of 850 cfs for health and safety purposes rather than increasing pumping to base operations after the VAMP/post-VAMP period to provide maximum protection for delta smelt. Although the exact duration of this action is unknown, it is believed that pumping may be able to resume when water temperatures in the south Delta reach 25°C, which is considered lethal for delta smelt and would indicate that most delta smelt would have moved into the cooler waters of the central Delta.

The CVP and the SWP are two major inter-basin storage and delivery systems that divert water from the southern portion of the Delta. The CVP and SWP are continually subject to new statutory, regulatory, contractually, and judicially-imposed requirements. CVP and SWP operations must be closely coordinated, and the details of this process were formally resolved by the signing of the COA in 1986. The Long-term CVP/SWP OCAP (Reclamation 2004) contains the operational standards by which Reclamation operates the integrated CVP/SWP system to divert, store, and convey water consistent with applicable legal requirements.

Reclamation and DWR completed an update to the OCAP in 2004 to reflect recent operational and environmental changes occurring throughout the CVP/SWP system, and submitted a BA to NMFS and USFWS describing and evaluating the updated criteria. The BA was submitted to USFWS in February 2004 for consultation regarding terrestrial species, and the BA was submitted to NMFS and USFWS in June 2004 for consultations regarding anadromous salmonids and delta smelt. In addition to current operations, the BA also considered several proposed future actions, including increased flows in the Trinity River system, increased pumping at Banks Pumping Plant, permanent barriers operated in the South Delta, the CVP/SWP Intertie, a long-term EWA Program or a program equivalent to the EWA, the FRWP, and various operational changes.

Reclamation received BOs from NMFS and USFWS in October 2004 and February 2005, respectively, and thereby completed its 2004/2005 Section 7 ESA consultations for the OCAP. The terms and conditions specified in the USFWS and NMFS BOs establish the instream habitat conditions and operational requirements that Reclamation and DWR must maintain as part of integrated CVP/SWP operations.

Due to numerous changed circumstances since the 2004/2005 OCAP consultation, Reclamation has requested re-initiation of Section 7 ESA consultation with both NMFS and USFWS. In the spring of 2006, Reclamation requested initiation of formal consultation on the effects of long-term CVP and SWP operations on all federally-listed species and critical habitats that may be affected by those operations, and to include the newly designated critical habitat for Central Valley steelhead, Central Coast steelhead, and Central Valley spring-run Chinook salmon. Reclamation also requested initiation of consultation on the effects of the OCAP on the federally-threatened southern DPS of North American green sturgeon, which converted into a formal consultation following the effective date of the final rule designating its status in July 2006. In addition, in a letter dated July 2006, Reclamation requested re-initiation of formal consultation on the OCAP with USFWS. The major reason for this re-initiation is changed circumstances regarding delta smelt populations, particularly related to new and constantly emerging information from the POD study effort in the Delta. At this time, the dates for the completion of these new consultations are unknown.

As discussed in Section 4.1.4, any conveyance of water provided by the Yuba Accord Alternative through the CVP/SWP system, the Delta and the Export Service Area would be consistent with all of the procedures and operating principles that are established in the new OCAP that Reclamation will adopt after completion of these new consultations.

This EIR/EIS acknowledges that there are numerous issues surrounding the pelagic organism decline, and recognizes that future Delta operations and management will differ from the operations and management that have been in place under the CEQA Existing Condition and the NEPA Affected Environment. As demonstrated by subsequent analyses beginning in Section 10.2.3 of this EIR/EIS, Reclamation has determined that the Proposed Project/Action would have sufficient operational flexibility so that it could be adjusted as necessary to protect listed species and, thus, would not cause irreversible or irretrievable commitments of resources that would limit the ability of NMFS, USFWS or Reclamation to formulate or implement reasonable and prudent alternatives as part of the ongoing 2006/2007 OCAP consultation.[4] Because any cross Delta transfers for EWA or other purposes must comply with operational requirements placed upon the CVP/SWP, any Delta-related actions of the Proposed Project/Action or an alternative would comply with the existing OCAP BOs, or successor documents.

Last year, the governor initiated a comprehensive Delta Vision process and appointed a Blue Ribbon Task Force to recommend future actions that will achieve a sustainable Delta (see Chapter 2). In addition, many state and federal agencies and environmental groups signed a formal Planning Agreement in September 2006 and are developing a Bay Delta Conservation Plan (BDCP) for at-risk fish species under the provisions of the state NCCPA and the ESA Section 10 that allow for Habitat Conservation Plans (HCP). These efforts also will provide a framework for future action (DWR Website 2007). Regardless of the nature of future actions and protective measures that will arise and be implemented to address the POD issues, implementation of the Proposed Project/Action or an alternative would be subject to any subsequent regulatory and operational constraints and CVP/SWP management direction surrounding pelagic fish species.

10.1.4.2 ANALYTICAL COMPONENTS EVALUATED TO ADDRESS POTENTIAL IMPACTS ON DELTA FISHERIES RESOURCES

Delta inflow and outflow are important for species residing primarily in the Delta (e.g., delta smelt and longfin smelt) (USFWS 1994), and for juveniles of anadromous species (e.g., Chinook salmon) that rear in the Delta prior to ocean entry. Seasonal Delta inflows and outflows affect several key ecological processes, including: (1) the migration and transport of various life stages of resident and anadromous fishes using the Delta (EPA 1992); (2) salinity levels at various locations within the Delta as measured by the location of X2; and (3) the Delta's primary (phytoplankton) and secondary (zooplankton) production.

The following analysis of Delta fish species focuses on the following federal or state listed or recreationally or commercially important fish species:

- American shad (*Alosa sapidissima*);
- Delta smelt (*Hypomesus transpacificus*);
- Longfin smelt (*Spirinchus thaleichthys*);
- Fall-run/late fall-run Chinook salmon (*Oncorhynchus tshawytscha*);
- Northern anchovy (*Engraulis mordax*);
- Spring-run Chinook salmon (*Oncorhynchus tshawytscha*);
- Starry flounder (*Platichthys stellatus*);
- Steelhead (*Oncorhynchus mykiss*);
- Striped bass (*Morone saxatilis*);
- Winter-run Chinook salmon (*Oncorhynchus tshawytscha*); and
- Green sturgeon (*Acipenser medirostris*).

The habitat requirements and distribution for Chinook salmon, striped bass, American shad, and delta smelt are largely representative of the habitat requirements and distribution of other

[4] Water transfers under the Proposed Action could be implemented in a flexible manner because the conditions under which YCWA would be deemed to have transferred water would depend on: (a) the CVP or SWP having available export pumping capacity at their Delta facilities; or (b) the CVP and SWP having the ability to reduce releases from CVP/SWP project reservoirs to "back up" YCWA water into Oroville Reservoir.

Delta fish species. Therefore, the analysis of effects on the above species will cover the range of potential effects on other Delta fishery resources evaluated in this EIR/EIS.

10.1.4.3 Facilities and Operations of the CVP and SWP and Their Effects on Aquatic Resources

STATE WATER PROJECT FACILITIES

SWP facilities in the Delta include the North Bay Aqueduct, Clifton Court Forebay, John E. Skinner Delta Fish Protection Facility, Harvey O. Banks Delta Pumping Plant, and the intake channel to the pumping plant. The North Bay Aqueduct would be unaffected by the Proposed Yuba Accord and, therefore, is not discussed further in this chapter. Banks Pumping Plant lifts water 244 feet to the beginning of the California Aqueduct. An open intake channel conveys water to Banks Pumping Plant from Clifton Court Forebay. The forebay provides storage for off-peak pumping and permits regulation of flows into the pumping plant. All water arriving at Banks Pumping Plant flows first through the primary intake channel of the John E. Skinner Delta Fish Protective Facility. Fish screens (louvers) across the intake channel direct fish into bypass openings leading into the salvage facilities. The main purpose of the fish facility is to reduce the number of fish adversely impacted by entrainment at the export facility and to reduce the amount of floating debris conveyed to the pumps.

Clifton Court Forebay

Clifton Court Forebay serves as a regulating reservoir providing reliability and flexibility for the water pumping operations at the Banks Pumping Plant (DWR and Reclamation 1994 *as cited in* DWR and Reclamation 1996a). The forebay has a maximum total capacity of 31 TAF. Five radial gates are opened during a high tide to allow the forebay reservoir to fill, and are closed during a low tide to retain water that supplies the pumps.

When the gates are open at high tide, inflow can be as high as 12,000 cfs for a short time, decreasing as water levels inside and outside the forebay reach equilibrium. This flow, at times, reaches velocities of 6-10 feet per second (fps) in the primary intake channel. Velocities decrease as water levels in the intake channel and forebay approach equilibrium. Starting in May 1994, gate operation patterns were adjusted to reduce entrainment of delta smelt into the forebay.

Fish that enter Clifton Court Forebay may take up residence in the forebay. Once in the forebay, fish may be eaten by other fish or taken by anglers (pre-screening losses); entrained by the pumps at the Banks Pumping Plant (direct losses); impinged on the fish screens at the Skinner Fish Protection Facility (direct loss); or bypassed and salvaged at the Skinner Fish Protection Facility (salvage). CDFG views predation on fish entrained into the forebay as a concern insofar as it may exceed natural predation rates in Delta channels.

Juvenile salmon, juvenile striped bass, and other species entrained into the forebay are exposed to high levels of predation before they can be salvaged at the Skinner Fish Protection Facility (DWR and Reclamation 1994 *as cited in* DWR and Reclamation 1996a). CDFG has conducted studies to assess the loss rate of juvenile salmon and striped bass that cross the forebay (Schaffter 1978; Hall 1980; CDFG 1985a, 1985b, 1992a, 1993; Brown and Greene 1992 *as cited in* DWR and Reclamation 1996a). The operation of the existing radial gates admits fish, along with water, into Clifton Court Forebay, where predation, salvage handling, and transport to another location in the Delta, entrainment, and other fates await them. The existing intake structure and gates are believed to provide cover and a feeding station for predators. Predation losses are believed to be very high. Based on studies of marked juvenile salmon released at the radial gates, mortality estimates of juvenile fall-run Chinook salmon traversing the forebay range from 63 to 98 percent.

Survival of young striped bass in Clifton Court Forebay also is low. Six percent of YOY striped bass released at the radial gates survived passage across the forebay (CDFG 1985a *as cited in* DWR and Reclamation 1996a).

The losses for both striped bass and salmon are attributed to predation. CDFG (1992a *as cited in* DWR and Reclamation 1996a) identified sub-adult striped bass as the major predatory fish in Clifton Court Forebay. These fish were most abundant near the radial gates during winter and spring, when small fish may be particularly vulnerable. Predators have been periodically removed from the forebay and released in the Delta. In 1993, striped bass made up 96 percent of the predators removed, followed by white catfish and channel catfish (Liston et al. 1994 *as cited in* DWR and Reclamation 1996a).

Loss rates of other fish species of concern, such as delta smelt, cannot be assessed accurately at this time. However, estimated salvage rates are discussed below.

John E. Skinner Fish Facility

The John E. Skinner Fish Facility includes primary and secondary louvers (screens) designed to guide fish to bypass and salvage facilities before they are drawn into the Banks Pumping Plant (Brown and Greene 1992 *as cited in* DWR and Reclamation 1996a). The primary fish screens are composed of a series of V-shaped bays containing louver systems resembling Venetian blinds that act as a behavioral barrier to fish. The secondary fish screen is a perforated plate, positive-pressure screen, which removes fish greater than about 20 mm in length. Salvaged fish are transported in trucks to one of several Delta release sites. Despite recent improvements in salvage operations, survival of species that are more sensitive to handling, such as delta smelt, is believed to be low (DWR and Reclamation 1994 *as cited in* DWR and Reclamation 1996a).

The fish screening and salvage facilities began operating in 1968 (Brown and Greene 1992 *as cited in* DWR and Reclamation 1996a). In the early 1970s, CDFG and DWR initiated extensive evaluations of the facility that have led to improved performance and reduced fish losses. Most of this effort focused on fall-run Chinook salmon, striped bass, and American shad. Screening efficiency studies have been proposed for delta smelt, but difficulties have arisen because the fish are susceptible to losses during handling and survive poorly in captivity. Alternative approaches are being investigated. A direct loss model has been developed by DWR and CDFG to estimate losses based on operations at the SWP south Delta facilities. This model can be used to estimate the effect of changes in operations on salmon and striped bass.

DWR conducts daily fish monitoring and fish salvage operations at the SWP Skinner Fish Facility. As part of the monitoring program at the Skinner Fish Facility, operations are monitored and information recorded on water velocities that affect louver guidance efficiency for various species and life stages of fish, species composition, the occurrence of coded-wire tag (CWT) and other marked fish released as part of experimental investigations, the length-frequency distribution for various species, and other information used to evaluate and monitor fish salvage operations. Fish entering the salvage facilities are subsampled, identified and measured, and subsequently returned to the Delta through a trucking and release operation.

Using data on the species composition and numbers of fish collected in each subsample, in combination with the percentage of time and volume subsampled, an expanded estimate of fish salvage is then derived and reported on both a daily and monthly basis. Fish loss is also calculated daily for several species (e.g., winter-run and spring-run Chinook salmon) by expanding the salvage estimate to account for approach velocities and resulting louver efficiencies, established estimates of pre-salvage predation mortalities, and estimates of trucking and handling mortalities.

The numbers of various fish species salvaged at the SWP Skinner Fish Facility and CVP Tracy Fish Facility show high variability on a seasonal basis and between years, reflecting variation in both the life history characteristics of many of the species and their vulnerability to salvage at the facility.

In general, the majority of juvenile Chinook salmon (primarily fall-run Chinook salmon) are observed in salvage operations during the late winter and early spring (February through May), although juvenile salmonids are also observed during the late fall and winter (November through January), which may include yearling spring-run and fall-run salmon, late-fall-run salmon smolts, and pre-smolt winter-run juvenile salmon. Steelhead are primarily observed in salvage during the spring months (March and April), which is consistent with the general seasonal timing for steelhead smolt out migration. Striped bass are observed in salvage operations throughout the year, with the majority of juvenile striped bass occurring during the summer months (May through July). Similarly, delta smelt are observed in the salvage operations throughout the year, with the majority of juvenile delta smelt occurring during the late spring and early summer (May through July). Larger sub-adult and adult delta smelt are typically observed in the salvage operation more predominantly during the fall, winter, and early spring. Longfin smelt are primarily observed in the salvage operations during the spring (March through May) as juveniles, although larger sub-adult longfin smelt are also observed in the salvage operations during the fall. Sacramento splittail are also observed in salvage operations throughout the year, although the majority of splittail YOY occur during the spring and early summer (March through July). A variety of other resident and migratory fish species are also collected as part of both CVP and SWP salvage operations.

Fish that are not bypassed by the salvage facility may survive passage through the pumps and enter the aqueduct. Fish, including striped bass and resident species, may rear in the canals and downstream reservoirs. These fish support recreational fisheries both in the aqueduct and in downstream reservoirs.

Harvey O. Banks Pumping Plant

The initial Banks Pumping Plant facilities, including seven pumps, were constructed in 1962. The pumping plant was completed in 1992 with the addition of four pumps. The total capacity of these eleven pumps is 10,668 cfs, with two pumps rated at 375 cfs, five at 1,130 cfs, and four at 1,067 cfs. Water is pumped into the California Aqueduct, which extends 444 miles into southern California.

Total annual exports at the Banks Pumping Plant have greatly increased since construction of the initial facilities. Operation of the SWP, in combination with CVP export operations, influences the hydrologic conditions within south-Delta channels. For example, export operations have an effect on water surface elevations within the south-Delta and subsequently operations of a number of siphons and irrigation pump diversions, which is being addressed, in part, through seasonal construction and operations of temporary barriers within the south-Delta channels. Export operations also influence water currents (both the direction and velocity) within various south-Delta channels, with the primary hydrologic effects occurring within Old and Middle rivers. Export operation effects on hydrologic conditions, and associated effects on habitat quality and availability for various fish and macroinvertebrates and the risk of entrainment and salvage at the CVP and SWP export facilities have been the subject of a number of programs. DWR (e.g., ISDP), SWRCB, USFWS, NMFS, and various experimental investigations including, but not limited to, the Vernalis Adaptive Management Plan (San Joaquin River Group Authority 2002; San Joaquin River Group Authority 2004) and others have conducted investigations on operational effects in the south Delta. As a result of these various proceedings, a number of management actions, including seasonal reductions in CVP and SWP export rates relative to Delta inflow (export/inflow ratio) and other actions such as short-term reductions in export operations based on actual observed salvage of sensitive fish species as part of CALFED EWA actions or in response to BOs, have been implemented to reduce or avoid adverse effects of changes in hydrologic conditions and the vulnerability of species to salvage operations.

Currently, average daily diversions are limited during most of the year to 6,680 cfs, as set forth by Corps criteria dated October 13, 1981. Diversions may be increased by one-third of San Joaquin River flow at Vernalis during mid-December to mid-March if that flow exceeds 1,000 cfs. The maximum diversion rate during this period would be 10,300 cfs, the nominal capacity of the California Aqueduct. Beginning in 2000, the Corps has authorized use of an additional 500 cfs of Banks Pumping Plant capacity in July through September, which has been used to make up export supply lost during pumping curtailments undertaken during other months for fish protection.

Additional limitations on export pumping are imposed by the State Water Resources Control Board, under its authority to issue water rights permits for the SWP. From 1991 to 1994, exports were also restricted under the BOs for winter-run Chinook salmon and delta smelt. The May 1995 "Water Quality Control Plan" established further restrictions on exports (SWRCB 1995a *as cited in* DWR and Reclamation 1996a). The new Water Quality Control Plan for the Bay/Delta Estuary that was adopted in December 2006 contains similar restrictions (SWRCB and California Environmental Protection Agency 2006).

CENTRAL VALLEY PROJECT FACILITIES

Reclamation operates the CVP facilities in the Delta, including the Jones Pumping Plant, Tracy Fish Collection Facility, and Delta Cross Channel.

Jones Pumping Plant

The Jones Pumping Plant is located adjacent to Clifton Court Forebay. The plant pumps directly from the Old and Middle Rivers. Its pumping capacity is 4,600 cfs, which is supplied to the Delta-Mendota Canal.

Tracy Fish Collection Facility

Fish salvage facilities at the Jones Pumping Plant are composed of a system of primary and secondary louvers (Brown and Greene 1992 *as cited in* DWR and Reclamation 1996a). Four bypasses placed equidistantly along the screen face direct fish from the primary louvers to a secondary set of louvers, where they are concentrated and bypassed to holding tanks. Salvaged fish are periodically transferred by truck to a release point in the Delta.

The Jones pumps are usually operated continuously, and because water is drawn directly from the Delta, pumping is subject to tidal influence, causing variation in channel velocity and approach velocities to fish screens (Brown and Greene 1992 *as cited in* DWR and Reclamation 1996a). In 1998, Reclamation published a report concerning fish collections and secondary louver efficiency from October 1993 to September 1995 at the Tracy Fish Collecting Facility (TFCF). The objectives of this study were to identify the fish populations moving through the secondary louvers and into the fish holding tanks (as a percent compared to the number of fish entering the channel), in addition to evaluating the efficiency of the secondary louvers relative to environmental and operational parameters. During the evaluation only two delta smelt were caught, while splittail was the species most routinely observed. The report concluded that the entrainment susceptibilities of several species are largely dependent on seasonal variation, suggesting that life history is associated with screen entrainment at the TFCF for species such as splittail and Chinook salmon. The mean efficiency for Chinook salmon was found to be 83 percent, the efficiency for white catfish to be 89 percent, the efficiency for splittail to be 63 percent, and the efficiency for striped bass to be 86 percent. However, screen efficiency may be lower since the facilities reconstruction (USBR 1998). Entrainment for American shad was most likely to occur during May through December when young American shad were moving downstream. In addition, American shad are two or more times more likely to move through the louvers during the day than at night. CDFG conducted efficiency tests on the primary louver system, which revealed that striped bass longer than 24 mm were effectively screened and bypassed. Similar results were observed for striped bass by Reclamation with an average screened fork length of 116 mm. However, planktonic eggs, larvae, and juveniles less than 24 mm in length received no protection from entrainment (Hallock et al. 1968 *as cited in* DWR and Reclamation 1996a). The tests also indicated that juvenile Chinook salmon would be effectively screened because they would be greater than 24 mm in length by the time they were exposed to the screens and pumps. Screening efficiency for delta smelt has yet to be determined.

10.1.4.4 COMBINED DOWNSTREAM EFFECTS OF THE CVP AND SWP FACILITIES

Local effects of the CVP and SWP facilities on fish, such as export losses and Cross Channel and Georgiana Slough diversions, are included in the above discussions of the facilities. In addition to these effects, the CVP and SWP facilities also influence downstream habitat conditions. These conditions include Delta outflow, salinity levels in the western Delta and the bays, the location of X2, and the levels of flow reversals in the lower San Joaquin River.

DELTA OUTFLOW

Water development has changed the volume and timing of freshwater flows through the Bay-Delta estuary. Each year, diversions reduce the volume of fresh water that otherwise would flow through the estuary (CALFED 2000). During this century, the volume of the estuary's fresh water supply that has been depleted each year by upstream diversions, in-Delta use, and Delta exports has grown from about 1.5 MAF to nearly 16 MAF. As a result, the proportion of Delta outflow depleted by upstream and Delta diversions has grown substantially.

Water development has also greatly altered seasonal flows into and through the estuary. Flows have decreased substantially in April, May, and June and have increased slightly during the summer and fall (EPA 1992). Seasonal flows influence the transport of eggs and young organisms through the Delta and into San Francisco Bay. Flows during the months of April, May, and June play an especially important role in the reproductive success and survival of many estuarine species including salmon, striped bass, American shad, delta smelt, longfin smelt, splittail, and others (Stevens and Miller 1983; Stevens et al. 1985; Herbold 1994; Meng and Moyle 1995 *as cited in* DWR and Reclamation 1996a).

SALINITY

In many segments of the estuary, and particularly in Suisun Bay and the Delta, salinity is controlled primarily by freshwater flow. By altering the timing and volume of flows, water development has affected salinity patterns in the Delta and parts of San Francisco Bay (SFEP 1992 *as cited in* DWR and Reclamation 1996a).

Under natural conditions, the Carquinez Strait/Suisun Bay area marked the approximate boundary between salt and fresh water in the estuary during much of the year. In the late summer and fall of drier years, when Delta outflow was minimal, seawater moved into the Delta from San Francisco Bay. Beginning in the 1920s, following several dry years and because of increased upstream storage and diversions, salinity intrusions became more frequent and extensive.

Since the 1940s, releases of fresh water from upstream storage facilities have increased Delta outflows during summer and fall. These flows have correspondingly limited the extent of salinity intrusion into the Delta. Reservoir releases have helped to ensure that the salinity of water diverted from the Delta is acceptable during the summer and late fall for farming, municipal, and industrial uses (SFEP 1992 *as cited in* DWR and Reclamation 1996a).

Salinity is an important habitat factor in the estuary. Estuarine species characteristically have optimal salinity ranges, and their survival may be affected by the amount of available habitat within the species' optimal salinity range. Because the salinity field in the estuary is largely controlled by freshwater outflows, the level of outflow may determine the surface area of optimal salinity habitat that is available to the species (Hieb and Baxter 1993; Unger 1994 *as cited in* DWR and Reclamation 1996a).

ENTRAPMENT ZONE LOCATION AND X2

The entrapment zone is an area of the estuary characterized by higher levels of particulates, higher abundances of several types of organisms, and maximal turbidity. It is commonly associated with the position of the 2 ppt salinity isopleth (X2), but actually occurs over a broader range of salinities (Kimmerer 1992 *as cited in* DWR and Reclamation 1996a). Originally, the primary mechanism responsible for this area was thought to be gravitational circulation, a circulation pattern formed when freshwater flows seaward over a dense, landward-flowing marine tidal current. However, recent studies have shown that gravitational circulation does not occur in the entrapment zone in all years, nor is it always associated with X2 (Reclamation et al. 1995 *as cited in* DWR and Reclamation 1996a). Lateral circulation within the estuary and chemical flocculation may play roles in the formation of the turbidity maximum of the entrapment zone.

As a consequence of higher levels of particulates, the entrapment zone may be biologically significant to some species. Mixing and circulation in this zone concentrates plankton and other organic material, thus increasing food biomass and production. Larval fish such as striped bass, delta smelt, and longfin smelt may benefit from enhanced food resources. Since about 1987, however, the introduced Asian clam population has reduced much of the primary production in the estuary and there has been virtually no enhancement of phytoplankton production or biomass in the entrapment zone (CUWA 1994 *as cited in* DWR and Reclamation 1996a).

Although little to no enhancement of the base of the food chain in the entrapment zone may have occurred during the past decade, this area continues to have relatively high levels of invertebrates and larval fish. Vertical migration of these organisms through the water column at different parts of the tidal cycle has been proposed as a possible mechanism that is maintaining high abundances in this area, but recent evidence suggests that vertical migration does not provide a complete explanation (Kimmerer 1992 *as cited in* DWR and Reclamation 1996a).

Although recent evidence indicates that X2 and the entrapment zone are not as closely related as previously believed (Reclamation et al. 1995 *as cited in* DWR and Reclamation 1996a), X2 continues to be used as an index of the location of the entrapment zone or area of increased biological productivity. Historically, the location of X2 has varied between San Pablo Bay (RK 50) during high Delta outflow and Rio Vista (RK 100) during low Delta outflow. In recent years, it has typically been located between approximately Honker Bay and Sherman Island (River km 70 to 85). X2 is controlled directly by the rate of Delta outflow, although changes in X2 lag behind changes in outflow. Minor modifications in outflow do not greatly alter the X2 location. The location of X2 during the late winter through spring (February through June) is included as a water quality objective in the 1995 Bay/Delta Water Quality Control Plan.

Jassby et al. ((1994) *as cited in* DWR and Reclamation 1996a) showed that when X2 is in the vicinity of Suisun Bay, several estuarine organisms tend to show increased abundances. However, it is by no means certain that X2 has a direct effect on any of the species. The observed correlations may result from a close relationship between X2 and other factors that affect these species.

10.1.5 EXPORT SERVICE AREA

10.1.5.1 SAN LUIS RESERVOIR

San Luis Reservoir is located in Merced County at an elevation of 543 feet msl and has a storage capacity of approximately 2 MAF. It was constructed as a storage reservoir for the integrated operations of the CVP/SWP system. Water flows from the Delta to San Luis Reservoir via the California Aqueduct and the Delta-Mendota Canal. Water is then pumped from the O'Neil Forebay into San Luis Reservoir during the winter and spring. During normal CVP/SWP operations the reservoir is drawn down by 100 feet or more during the late-summer and early-fall. San Luis Reservoir provides habitat for both coldwater and warmwater fish species which include largemouth bass, striped bass, crappie, bluegill, bullhead catfish, shad, yellow perch and occasional white sturgeon (California State Parks Website 2003). Fish production in San Luis Reservoir is generally limited by changes in water elevations during critical spawning periods, overall reservoir levels, and the availability of shallow near-shore rearing habitat. Stocking by CDFG keeps the reservoir well supplied with trout. Bass fishing derbies are often held here, and crappie and bluegill are also caught.

10.1.6 REGULATORY SETTING

10.1.6.1 FEDERAL

ENDANGERED SPECIES ACT

The ESA requires that both USFWS and NMFS maintain lists of threatened species and endangered species. An "*endangered species*" is defined as "*…any species which is in danger of extinction throughout all or a significant portion of its range*." A "*threatened species*" is defined as "*…any species that is likely to become an endangered species within the foreseeable future throughout all* *or a significant portion of its range*" (16 USC 1532). Section 9 of the ESA makes it illegal to "*take*" (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct) any endangered species of fish or wildlife, and regulations contain similar provisions for most threatened species of fish and wildlife (16 USC 1538).

Section 7 of the ESA requires all federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat. To ensure against jeopardy, each federal agency must consult with USFWS or NMFS, or both, if the federal agency determines that its action might impact a listed species. NMFS jurisdiction under the ESA is limited to the protection of marine mammals and fishes and anadromous fishes; all other species are within USFWS jurisdiction.

Essential Fish Habitat

Section 305(b)(2) of the 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) added a provision for federal agencies to consult with National Marine Fisheries Service (NMFS) on impacts to EFH. EFH only applies to commercial fisheries; therefore, for the Proposed Action addressed within this Biological Assessment (BA) this means all Chinook salmon habitat, but not steelhead habitat. EFH includes specifically identified waters and substrate necessary for fish spawning, breeding, feeding, or growing to maturity. Consultation on any activity that might adversely affect EFH is required by NMFS under the MSFCMA, as amended by the Sustainable Fisheries Act of 1996. EFH includes all habitats necessary to allow the production of commercially valuable aquatic species, to support a long-term sustainable fishery, and contribute to a healthy ecosystem (JSA 2004).

10.1.6.2 STATE

CALIFORNIA ENDANGERED SPECIES ACT

The California Endangered Species Act (CESA, Fish and Game Code Sections 2050 to 2089) establishes various requirements and protections regarding species listed as threatened or endangered under state law. California's Fish and Game Commission is responsible for maintaining lists of threatened and endangered species under CESA. CESA prohibits the "*take*" of listed and candidate (petitioned to be listed) species (Fish and Game Code Section 2080) "*Take*" under California law means to *"…hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch capture, or kill…"* (Fish and Game Code Section 86).

SECTION 1600 ET SEQ. OF THE CALIFORNIA FISH AND GAME CODE

All diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by CDFG, pursuant to Sections 1600-1616 of the California Fish and Game Code. Under Section 1602, it is unlawful for any person to substantially divert or obstruct the natural flow or substantially change the bed, channel or bank of any river, stream or lake designated by CDFG, or use of any material from the streambeds, without first notifying CDFG of such activity and obtaining a CDFG Streambed Alteration Agreement.

10.1.6.3 LOCAL

FERC originally issued a license under the Federal Power Act (FPA) for the Yuba Project on May 16, 1963. On May 6, 1966, FERC issued an order amending this license. The amended license contains release and instream flow requirements similar to those in the 1965 YCWA/CDFG agreement, which is described in Chapter 2, Environmental Setting and CEQA Existing Condition.

YCWA's FERC license was amended on November 22, 2005 to specify more-stringent ramping and flow fluctuation criteria downstream of Narrows II Powerhouse than were in the 1966 FERC license. On November 4, 2005, NMFS issued a biological and conference opinion pursuant to ESA Section 7 concluding that the modified ramping and flow fluctuation criteria are not likely to jeopardize the continued existence of federally-listed fish species in the lower Yuba River, or destroy or adversely modify designated critical habitat. NMFS also concluded that the modified ramping and flow fluctuation criteria likely would result in take of listed species and issued an incidental take statement including reasonable and prudent measures (RPMs) and associated terms and conditions for implementing the RPMs (NMFS 2005b). Specific ramping and flow fluctuation criteria are included in the November 22, 2005 FERC license amendment (FERC Project No. 2246-047).

10.2 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES

10.2.1 IMPACT ASSESSMENT METHODOLOGY

The impact assessment relies on mass balance hydrological modeling to provide a quantitative basis from which to assess the potential impacts of the Project Project/Action and alternatives on fish species of management concern and aquatic habitats within the regional Study Area, relative to the basis of comparison. Specifically, the hydrological modeling analyses and post-processing applications are utilized to simulate data representing Yuba River Basin and Central Valley Project/State Water Project (CVP/SWP) operational conditions that would occur from implementation of the Proposed Project/Action and alternatives, which are compared to modeled data representing operational conditions under the basis of comparison.

Both quantitative and qualitative assessments were completed to evaluate potential operational impacts on aquatic resources. Hydrological and water temperature modeling was performed to provide a quantitative basis from which to assess potential impacts of the Proposed Project/Action and alternatives on fisheries resources and aquatic habitats within the Yuba Region, CVP/SWP Upstream of the Delta Region, Delta Region and Export Service Area (San Luis Reservoir). Specifically, the hydrological modeling and post-processing applications were utilized to simulate operations expected to occur in the mainstem rivers (e.g., lower Yuba, Feather, and Sacramento) as a result of the Proposed Project/Action and alternatives compared to the bases of comparison.

The methodologies used to predict comparative operational scenarios under the Proposed Project/Action and alternatives, relative to the bases of comparison are described in the subsequent discussions.

In addition to the models described above, other studies utilizing the Instream Flow Incremental Methodology (IFIM) on the lower Yuba and Feather Rivers are examined to correlate changes in flow regimes to changes in the amount of physical habitat available for spawning of fish species of management concern.

The physical habitat simulation (PHABSIM) system is a very commonly used study method for conducting IFIM studies. PHABSIM is the collection of one-dimensional hydraulic and habitat models, which can be used to predict the relationship between instream flows and the physical habitat for various life stages of one or more species of fish (Bovee *et al.* 1998). In general, three main components contribute to PHABSIM results. First, measurements of water depth, water velocity, substrate material and cover are taken at specific sampling points along several stream cross sections, at different flow levels. Next, the measured data are used to create hydraulic models (i.e., models that describe the movement and force of water), which evaluate and predict habitat variables (e.g., water depth, water velocity, substrate, and cover) throughout a selected study site at different flows. The hydraulic models, in turn, are combined with Habitat Suitability Curve (HSC) models that evaluate the relative incremental utility of habitat attributes to life stage and species under consideration. The final result is a relationship between instream flow and physical habitat availability, expressed as Weighted Usable Area (WUA), predicted over a range of stream discharges (Bovee *et al.* 1998). Two-dimensional modeling is similar to one-dimensional PHABSIM modeling in that standard HSC can be utilized in the analysis and the results are expressed either as WUA or as an index relating habitat and flow. The USFWS is in the process of developing updated WUA-discharge relationships for Chinook salmon and steelhead in the lower Yuba River, using both PHABSIM and two-dimensional modeling approaches. However, these updated WUA-discharge relationships were not available at the time of preparation of this EIR/EIS.

10.2.1.1 Analytical Approach for Evaluating Fisheries and Aquatic Resources in Reservoirs

Implementation of the Proposed Project/Action and alternatives could result in alterations to storage levels and water surface elevations in New Bullards Bar, Oroville, and San Luis reservoirs. Fluctuations in these reservoirs, in response to operations and changes in runoff patterns, potentially can affect reservoir fish species due to alterations in the timing and magnitude of reservoir drawdowns. Methods used to determine potential impacts on reservoir fish species are discussed below for each individual reservoir potentially affected by Proposed Project /Action and alternatives. Parameters used to determine impacts include:

- End-of-month water surface elevations under Proposed Project/Action and alternatives compared to bases of comparison
- End-of-month reservoir storage levels under Proposed Project/Action and alternatives compared to bases of comparison

10.2.1.2 Analytical Approach for Evaluating Fisheries and Aquatic Resources in Rivers (Flow)

Long-term Average Flow and Average Flow by Water Year Type

The Graphic and Tabular Analysis for Environmental Resources (GATAER) post-processing tool utilizes CALSIM output (i.e., monthly flow data) to calculate the long-term average flows, by month, occurring over the 1922 through 1993 simulation period under the bases of comparison and the Proposed Project/Action and alternatives. Average simulated flows by water year type, as defined by the Sacramento Valley 40-30-30 Index, also are calculated for the bases of comparison and the Proposed Project/Action and alternatives. Presented in tabular format, the data tables for the long-term average flows by month, and the average flows by water year type demonstrate the changes that could be expected to occur with implementation of the Proposed Project/Action and alternatives, relative to the bases of comparison.

Because the Yuba River is not part of the integrated CVP/SWP system, hydrological changes in the Yuba River cannot be simulated by CALSIM. Therefore, a separate Yuba Basin model (i.e., the Yuba Basin Sub-module) has been developed for this purpose. The Yuba Basin Sub-module is used to compile a time series database for the period of record to provide an indication of flow changes associated with Proposed Yuba Accord operations (i.e., water transferred under the Water Purchase Agreement) in relation to water available for CVP/SWP system use or storage (e.g., considering CVP/SWP pumping limitations or other restrictions depending upon the time of the year). Yuba River model output is then incorporated into the post-processing applications by routing the Yuba River water through the CVP/SWP water system to simulate the various comparative scenario conditions for the Proposed Yuba Accord.

FLOW EXCEEDANCE CURVES

Flow exceedance curves have been developed for the 1922 through 1993 simulation period and illustrate the distribution of simulated flows under the Proposed Project/Action and alternatives and the bases of comparison. The flow exceedance curves are developed utilizing the Weibull method (Weibull 1939 *as cited in* USGS 1977), which historically has been used by hydrologists in the United States for plotting flow-duration and flood-frequency curves. In general, flow exceedance curves represent the probability, as a percent of time that modeled flow values would be met or exceeded at an indicator location during a certain time period. Therefore, exceedance curves demonstrate the cumulative probabilistic distribution of flows for each month at a given river location under a given simulation.

Exceedance curves are particularly useful for examining flow changes occurring at lower flow levels. Results from past instream flow studies indicate that Chinook salmon spawning and rearing habitat is most sensitive to changes during lower flow conditions (CDFG 1994; USFWS 1985).

Changes in rearing habitat also are examined using flow exceedance curves. Rearing habitat area tends to reach maximum abundance at low flows that inundate most of the channel area in a river (Reclamation and Freeport Regional Water Authority 2003). Rearing habitat area declines as flows increase, primarily in response to increased average velocity. Because juvenile Chinook salmon and steelhead fry generally prefer low velocity areas, increasing flows often lead to reductions in habitat area. However, this flow-habitat relationship may be misleading because it may not adequately reflect local habitat conditions (i.e., availability of low velocity) or the importance of flow-related habitat attributes (e.g., water temperature conditions or cover and prey availability). Given the uncertainty of flow-habitat relationships associated with anadromous salmonid rearing, the effects assessment evaluates changes in low flow conditions (e.g., flows for critical and dry year types). In accordance to the selected flow criteria (i.e., ≥ 10%) described above, a change in the lowest quartile distribution (i.e., 25th percentile) of 10 percent or greater is considered in relation to the magnitude of flows under the bases of comparison. This approach is consistent with the methodology included in previous environmental documentation, including the *Freeport Regional Water Project Draft EIS/EIR* (Reclamation and Freeport Regional Water Authority 2003).

FLOW REPLACEMENT PLOTS

Flow replacement plots have been developed for the 1922 through 1993 simulation period. The replacement plots illustrate the one-to-one relationship (i.e., flows that would occur under one of the Proposed Project/Action and alternatives, and one of the bases of comparison during the same year) between flows for each of the 72 years in the simulation period. A replacement plot illustrates each of the individual yearly flow changes during a given month under one of the Proposed Project/Action and alternatives, relative to one of the bases of comparison. Replacement plots are utilized in the flow analyses to report the number of years for each individual month when flows deviate from the one-to-one replacement line, indicating a change in flow within that month, under one of the Proposed Project/Action and alternatives, relative to one of the bases of comparison.

FLOW DEPENDENT HABITAT AVAILABILITY

Flow dependent habitat availability refers to the quantity and quality of habitat available to individual species and life stages for a particular instream flow. Typically, the relationship between instream flow and the quantity and quality of instream habitat is expressed in terms of weighted usable area (WUA) produced by a particular flow level (SWRI 2002).

For the Chinook salmon adult spawning life stage, *flow dependent habitat availability* refers to the amount of appropriate spawning habitat, including the suitable water depths, velocities and substrate, for successful spawning that is, in part, contingent on stream flow. Salmonids typically deposit eggs within a range of depths and velocities that ensure adequate exchange of water between surface and substrate interstices to maintain high oxygen levels and remove metabolic wastes from the redd. Stream flow directly affects the availability of appropriate spawning habitat (SWRI 2002). In general, the amount of habitat suitable for spawning increases with increasing stream flow; however, stream flows above a certain level do not provide additional habitat, and excessive stream flows can cause scouring of the substrate, resulting in mortality to developing eggs and embryos (Spence *et al.* 1996).

The potential impacts of annual monthly flows on the adult spawning life stage of lower Feather River and lower Yuba River salmonids are evaluated through the spawning habitat available to the species throughout their spawning seasons, as expressed by a scaled (or scaled composite) WUA. The scaled WUA is the WUA for a particular flow expressed as a percentage of the maximum WUA. The scaled composite WUA is identical to the scaled WUA except that the scaled WUA is weighted to incorporate the spatial and temporal distribution of spawning for the salmonid run of interest.

In the Feather River, the present spawning habitat analysis is applied to Chinook salmon (without differentiating between spring and fall-runs), and to steelhead spawning in an upper reach extending from the Fish Barrier Dam (RM 67) downstream to the Thermalito Afterbay Outlet (RM 59) and a lower reach extending from downstream of the Thermalito Afterbay Outlet to Honcut Creek (RM 44). Based on the 2002 through 2004 Schaefer spawning escapement estimates, these two reaches account for 62 percent and 38 percent of the spawning distribution of Chinook salmon. DWR (2003b) reports that 72 percent and 28 percent of the steelhead spawning occurs in the upper and lower reaches, respectively. For Feather River Chinook salmon, the temporal spawning distribution does not show a bimodal distribution as would be expected if there were a distinct temporal spawning segregation (DWR 2004b). Because no clear distinction between spring- and fall-run Chinook salmon spawning can be derived from survey data, the WUA analysis used to analyze potential impacts on the two runs is combined into one expanded spawning season that is inclusive of all Chinook salmon spawning in the Feather River.

In the Yuba River, spring-run Chinook salmon are believed to spawn from early September through early November (CDFG Exhibit 26 *in* SWRCB 2001). Fall-run Chinook salmon are generally believed to spawn from October into January. CDFG considers spawning activity in September to represent spring-run Chinook salmon based on historic information, although CDFG acknowledges that spring-run and fall-run Chinook salmon are no longer spatially isolated.

Detailed descriptions of the spawning habitat-discharge analytical approach for the Feather and lower Yuba rivers are provided in Appendix E1.

CHARACTERIZATION OF MEASURABLE FLOW DETECTION LIMITS

The hydrological models used in the analyses, although mathematically precise, should be viewed as having "reasonable detection limits." Establishing reasonable detection limits is useful to those using the modeling output for impact assessment purposes, and prevents making inferences: (1) beyond the capabilities of the models; and (2) beyond an ability to actually measure changes.

For analytical purposes, *"measurable changes"* have been established and are addressed as part of the impact assessment to account for: (1) detection limits resulting from modeling artifacts (e.g., rounding and simplifying assumptions); and (2) the ability of the monitoring equipment to accurately measure data parameters in the field (e.g., input data accuracy). The establishment of measurable detection limits provides a means of analyzing meaningful differences in simulated flow changes that may occur between the Proposed Project/Action and alternatives, and the bases of comparison at a given location. Measurable changes are further examined in the impact assessment to determine whether these changes are representative of potentially adverse impacts on listed fisheries resources being evaluated.

To establish the percentages of measurable changes in flow, several sources were reviewed. The *Handbook of Hydrology* (Maidment 1993) specifies the following standard to ensure that hydrometeorological information is of sufficient accuracy to meet the objectives of the National Hydrology Reference Network… *"At any one measuring station, 95 percent of all flows estimated from a stage record with a rating shall be within ±8 percent of the actual value."* USGS also provides criteria aimed to determine the accuracy of the data collected. On the *Water Resources Data California Water Year 2002*, USGS states "*…the accuracy of stream flow records depends primarily on (1) the stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements; and (2) the accuracy of measurements of stage and discharge, and interpretation of records. Further, the accuracy attributed to the records is indicated under "REMARKS." "Excellent" means that about 95 percent of the daily discharges are within five percent of the true; "good," within ten percent; and "fair," within 15 percent. Records that do not meet the criteria mentioned are rated "poor." Different accuracies may be attributed to different parts of a given record.*"

As discussed above, USGS considers 10 percent to be acceptable or good, and five percent to be excellent. The *Handbook of Hydrology* specifies eight percent of the actual value to be the appropriate standard of accuracy. For these flow analyses, the standard used to evaluate measurable changes is more rigorous, relative to the standards discussed above. Two modeled simulations resulting in river flows within one percent of each other at a given location are considered essentially equivalent. Therefore, flow changes occurring between two simulations (e.g., any of the Proposed Project/Action and alternatives and any of the bases of comparison) at a given location must be one percent or greater to be considered a *"measurable"* difference. As a data reduction exercise, mean monthly flow results used in the analyses are limited to actual changes that could be measured (i.e., ≥ 1.0%). The reduced data set, which excludes the months in which project-related flows would be essentially equivalent to flows under the bases of comparison, is used to evaluate the months in which project-related changes in flow are greater than one percent, relative to the basis of comparison. Similar applications of modeled output are applied to other output parameters to assure the reasonableness of the impact assessment.

Additionally, a decrease in monthly flow of 10 percent or greater has been previously identified by various environmental documents as an appropriate criterion to evaluate flow changes. For example, in the *Trinity River Mainstem Fishery Restoration Draft EIS/EIR* (USFWS *et al.* 1999), the USFWS identified reductions in flow of 10 percent or greater as changes that could be sufficient to reduce habitat quantity or quality to an extent that could significantly affect fish. The Trinity River EIS/EIR further states, *"…[t]his assumption [is] very conservative…[i]t is likely that reductions in stream flows much greater than 10 percent would be necessary to significantly (and quantifiably) reduce habitat quality and quantity to an extent detrimental to fishery resources."* Conversely, the Trinity River EIS/EIR considers increases in stream flow of 10 percent or greater, relative to the basis of comparison, to be *"beneficial"* to fish species.

In addition to the USFWS criteria, the *San Joaquin River Agreement EIS/EIR* (San Joaquin River Group Authority 1999) utilized USGS 1977 criteria thresholds, which were derived based on the ability to accurately measure stream flow discharges to ±10 percent. The criterion used to determine the level of riverine impacts associated with implementation of the San Joaquin Agreement was based on average percentage changes to stream flow relative to the basis of comparison. The *San Joaquin River Agreement EIS/EIR* considered instream flow changes of less than ±10 percent to be insignificant (San Joaquin River Group Authority 1999).

The *Freeport Regional Water Project Draft EIR/EIS* (Jones & Stokes 2003) used a similar rationale as the USGS documentation for selecting criteria to evaluate changes in flow. The Freeport EIR/EIS states: *"Relative to the base case, a meaningful change in habitat is assumed to occur when the change in flow equals or exceeds approximately 10 percent. The 10 percent criterion is based on the assumption that changes in flow less than 10 percent are generally not within the accuracy of flow measurements, and will not result in measurable changes to fish habitat area."*

Although the environmental documents listed above have been legally certified (i.e., *Trinity River Mainstem Fishery Restoration Record of Decision* December 19, 2000; *San Joaquin River Agreement Record of Decision* in March 1999; *Freeport Regional Water Project Record of Decision January 4, 2005*), biological justifications specific to using a 10 percent change as a criterion for a meaningful change in habitat affecting fisheries resources in a particular river have not been provided. Nevertheless, these documents apparently have resulted in consensus in the use of 10 percent when evaluating flow changes. Accordingly, this fisheries impact assessment relies on previously established information and, therefore, evaluates changes of 10 percent or greater in monthly mean flows under the Proposed Project/Action and alternatives, and the bases of comparison.

ANALYTICAL APPROACH (FLOW)

For the purpose of detecting potential long-term trends, the flow assessment initially compares long-term average flows under the Proposed Project/Action and alternatives to long-term average flows under the bases of comparison. The long-term trend analysis requires consideration of each year that is part of the simulation period, including years in which no change occurs, because each of the 72-years included in the simulation period can influence long-term average flow conditions and, thus, no additional data reduction mechanisms are employed. Therefore, any numerical change in long-term average flows, as well as the percent change, is evaluated as part of the analysis and presented for discussion purposes.

Specific discussion regarding modeled flow changes that are considered to be essentially equivalent for a given fish species or life stage is not presented in subsequent sections of the document that contain the impact assessment. However, any species or life stages during which flows under the Proposed Project/Action and alternatives are essentially equivalent to flows under the bases of comparison are identified at the beginning of the impact assessment for disclosure purposes. The more detailed, species-specific impact assessments focus on those flow changes that are measurable. Therefore, measurable flow changes greater than one percent are used to evaluate potential flow impacts of the Proposed Project/Action and alternatives, relative to the bases of comparison. Besides considering the long-term average flows and average flows by water year type, the analyses consider individual monthly changes in flow of 10 percent or greater over the 72-year period under the Proposed Project/Action and alternatives, relative to the bases of comparison. However, it also is recognized that water temperature changes often exhibit a greater influence on fisheries resources and aquatic habitat utilization. Thus, the flow analyses are supplemented by separate species-specific water temperature analyses.

10.2.1.3 ANALYTICAL APPROACH FOR EVALUATING FISHERIES AND AQUATIC RESOURCES IN RIVERS (WATER TEMPERATURE)

LONG-TERM AVERAGE WATER TEMPERATURE AND AVERAGE TEMPERATURE BY WATER YEAR TYPE

The GATAER post-processing tool utilizes CALSIM output (i.e., monthly water temperature data) to calculate the long-term average water temperatures, by month, occurring over the 1922 through 1993 simulation period under the bases of comparison and the Proposed Project/Action and alternatives. Average simulated water temperatures by water year type, as defined by the Sacramento Valley 40-30-30 Index, also are calculated for the bases of comparison and the Proposed Project/Action and alternatives. Long-term average water temperatures for each month and average water temperatures by water year type are presented in tabular format, and demonstrate the changes that could be expected to occur with implementation of any of the Proposed Project/Action and alternatives, relative to the bases of comparison. The modeling approach for water temperature in the Yuba River is described in Appendix B of the Modeling Technical Memorandum (Appendix D of this EIR/EIS).

WATER TEMPERATURE EXCEEDANCE CURVES

Water temperature exceedance curves have been developed for the 1922 through 1993 simulation period and illustrate the distribution of simulated water temperatures under the Proposed Project/Action and alternatives, and the bases of comparison. In general, water temperature exceedance curves represent the probability, as a percent of time, that modeled water temperature values would be met or exceeded at an indicator location during a certain time period. Therefore, exceedance curves demonstrate the cumulative probabilistic distribution of water temperatures for each month at a given river location under a given simulation. To accommodate the complete range of seasonal thermal variability, to the nearest 0.3°F, exceedance curve scaling is set at different resolutions during the winter (i.e., 40ºF to 60ºF) and summer (i.e., 50ºF to 70ºF) months within the 72-year simulation period. The curves illustrate the percent exceedance probabilities that water temperatures under the Proposed Project/Action and alternatives, relative to the bases of comparison remain essentially equivalent (i.e., -0.3ºF ≤ X ≤ 0.3ºF). The curves also illustrate the percent exceedance probabilities that water temperature increases of more than 0.3ºF, and water temperatures decreases of more than 0.3ºF, occur under the Proposed Project/Action and alternatives, relative to the bases of comparison.

WATER TEMPERATURE REPLACEMENT PLOTS

Water temperature replacement plots have been developed for the 1922 through 1993 simulation period. The replacement plots illustrate the one-to-one relationship (i.e., water temperatures that would occur under one of the Proposed Project/Action and alternatives, and one of the bases of comparison during the same year) between water temperatures for each of the 72-years included in the simulation period.

CHARACTERIZATION OF MEASURABLE WATER TEMPERATURE DETECTION LIMITS

The water temperature models used in the analyses, although mathematically precise, should be viewed as having "reasonable detection limits." Establishing reasonable detection limits is useful to those using the modeling output for impact assessment purposes, and prevents making inferences: (1) beyond the capabilities of the models; and (2) beyond an ability to actually measure changes.

For analytical purposes, *"measurable changes"* have been established and are addressed as part of the impact assessment to account for: (1) detection limits resulting from modeling artifacts (e.g., rounding and simplifying assumptions); and (2) the ability of the monitoring equipment to accurately measure data parameters in the field (e.g., input data accuracy). The establishment of measurable detection limits provides a means of analyzing meaningful differences in simulated water temperature changes that may occur between the Proposed Project/Action and alternatives, and the bases of comparison at a given location. Measurable changes are further examined in the impact assessment to determine whether these changes are representative of potentially adverse impacts on listed fisheries resources being evaluated.

Reclamation has developed water temperature models (Reclamation 1997) for all SWP/CVP project rivers based on monthly reservoir water temperatures, hydrologic and climatic data, and the operations during the 72-year simulation period in the CALSIM model (Reclamation Unpublished Work). In-situ temperature loggers were used to collect water temperature data used for the models. These loggers typically have a precision of ±0.36°F, yielding a potential total error of 0.72°F (Deas *et al.* 1997). Therefore, modeled differences in water temperature of 0.36°F or less could not be consistently detected in the river by actual monitoring of water temperatures. In addition, as mentioned above, output from Reclamation's water temperature models provides a "relative index" of water temperatures under the various operational conditions modeled. Output values indicate whether the water temperatures would be expected to increase, remain unchanged, or decrease, and provide insight regarding the relative magnitude of potential changes under one operational condition compared to another.

For the purposes of this impact assessment, modeled water temperature changes that are within 0.3°F between modeled simulations are considered to represent no measurable change (i.e., were considered to be "essentially equivalent"). A level of detection of measurable change of 0.3°F is used because: (1) model output is reported to the one-tenth degree Fahrenheit; (2)

rounding the level of error associated with in-situ temperature loggers used for model temperature data up to 0.4°F would eliminate the possibility of detecting measurable change between 0.36°F and 0.4°F; and (3) rounding the level of detection down to 0.3°F is the more rigorous approach in detecting a change in temperature between the modeling results. Temperature differences between modeling results of more than 0.3°F are assessed for their biological significance.

Modeled mean monthly water temperature changes occurring among the Proposed Project/Action and alternatives, and the bases of comparison that are less than or equal to 0.3°F are considered to represent no measurable change (i.e., considered to be "essentially equivalent"). The reduced data set, which excludes the months in which water temperatures under the Proposed Project/Action and alternatives are essentially equivalent to water temperatures under the bases of comparison, is used to evaluate the number of occurrences, as well as the frequency and sequencing of such occurrences, in which measurable water temperature changes under the Proposed Project/Action and alternatives would result in a shift either above or below an applicable temperature indicator value, relative to the bases of comparison.

ANALYTICAL APPROACH (WATER TEMPERATURE)

For the purpose of detecting potential long-term trends, the water temperature assessment initially compares long-term average water temperatures under the Proposed Project/Action and alternatives to long-term average water temperatures under the bases of comparison. The long-term trend analysis requires consideration of each year that is part of the simulation period, including years in which no change occurs, because each of the 72-years included in the simulation period can influence long-term average water temperature conditions and, thus, no additional data reduction mechanisms should be employed. Therefore, any numerical change in long-term average water temperatures, as well as the percent change, are evaluated as part of the analysis and presented for discussion purposes.

Average simulated water temperatures by water year type, as defined by the Sacramento Valley 40-30-30 Index, also are calculated for the basis of comparison and the Proposed Project/Action and alternatives. Presented in tabular format, the data tables for the long-term average water temperatures by month, and the average water temperatures by water year type demonstrate the changes that could be expected to occur with implementation of any of the Proposed Project/Action and alternatives, relative to the basis of comparison.

Specific discussion regarding modeled water temperature changes that are considered to be essentially equivalent for a given fish species or life stage is not presented in subsequent sections of the document that contain the impact assessment. However, any species or life stage for which water temperature changes under the Proposed Project/Action and alternatives are essentially equivalent to the bases of comparison are identified at the beginning of the impact assessment for disclosure purposes. The more detailed, species-specific impact assessments focus on those water temperature changes that are measurable, and which potentially could result in biologically significant impacts on the species.

Riverine Early Life Stage Survival Analytical Approach

Reclamation's Salmon Mortality Model is used to assess potential water temperature-related impacts on the early life stage survival of Chinook salmon in the Feather River[5]. Water temperature output from Reclamation temperature models is used in the Salmon Mortality Model (Reclamation 1991) to characterize water temperature-related losses of early life stages of Chinook salmon under the Proposed Project/Action and alternatives, relative to the bases of comparison. Model output represents the percentage of potential emergent fry produced, based on all eggs brought to the river by spawning adults, that would survive under the temperature regime that would occur under each model simulation. The Salmon Mortality Model calculates temperature-induced mortality (the percentage of potential emergent fry lost as a result of temperature-induced mortality of pre-spawned eggs, fertilized eggs incubating in the gravel, and pre-emergent fry).

As discussed in the Trinity River EIS/EIR (USFWS *et al.* 1999), the Salmon Mortality Model uses weekly average water temperatures obtained from the water temperature models and tracks water temperature impacts on Chinook salmon egg and larval (sac-fry) development. Algorithms are used to compute the cumulative survival of eggs spawned in a particular week through fry emergence from the spawning gravel. Temperature mortality schedules (relationships) for Chinook salmon eggs and larvae were developed that establish temperature-related instantaneous daily mortality rates for modeling salmon losses. Nine Feather River reaches, characterized by three reaches in the "Low Flow Channel (LFC)", extending from the Fish Barrier Dam (RM 65.0) to upstream of the Thermalito Afterbay (RM 62.0), and six reaches in the "High Flow Channel (HFC)", extending downstream from the Thermalito Afterbay Outlet (RM 55.0) to the mouth of the lower Yuba River, are used in the analysis of Chinook salmon temperature-related mortality.

Within each river reach, a specific temperature-related mortality estimate is calculated. From these three partial mortality estimates, a cumulative mortality estimate, for each run, is then calculated for each water year for the simulation period (72 years). The complements (survival = 100 - mortality) of these calculated percent losses are discussed for impact assessment purposes. For this analysis, annual early life stage survival estimated for the Proposed Project/Action and alternatives is compared to survival estimated for the bases of comparison for each year of the 72-year simulation period.

The assessment of early life stage survival resulting from implementation of the Proposed Project/Action and alternatives, relative to the bases of comparison, involves the examination of several parameters. These parameters include: (1) absolute difference (percent increase); (2) relative difference (percent change); and (3) three or more consecutive years with reduced early life stage survival. Examination of the absolute difference allows for a straightforward comparison of the two simulations being examined. Increases and decreases in early life stage survival for the two simulations assessed, relative to each other, are discerned by focusing on

[5] For the purposes of improved technical accuracy and analytical rigor, simulated Chinook salmon early life stage survival estimates specific to the Feather River are derived from a revised version of Reclamation's Salmon Mortality Model (2004), which incorporates new data associated with: (1) temporal spawning and pre-spawning distributions; and (2) mean daily water temperature data in the Feather River. Although the updated Feather River information used as inputs into the model deviates slightly from that which was used in Reclamation's OCAP BA, both versions of the model are intended for planning purposes only and, thus, should not be used as indications of actual real-time in-river conditions. Because a certain level of bias is inherently incorporated into these types of planning models, such bias is uniformly distributed across all modeled simulations, including both the Project Alternatives as well as the bases of comparison, regardless of which version of the model is utilized.

the absolute difference. Examination of the relative difference is necessary to avoid the masking of more severe impacts on evaluated species, and to fully evaluate the biological significance of changes in water temperature conditions. Relative difference comparisons appropriately assess the magnitude of change in conditions between the Proposed Project/Action and alternatives, and the bases of comparison. Because the Chinook salmon life cycle extends over several years, examination of periods of three or more consecutive years of reduced early life stage survival is fundamental for examination of future adult returns and potential future recruitment from a given spawning stock, which may affect the population dynamics of the subsequent generation(s) of Central Valley Chinook salmon. Because 10 percent to 70 percent of Chinook salmon return as age two to age three fish (SWRI 2001), *s*ubstantial reductions in salmon survival over three or more consecutive years would encompass an entire life cycle for the majority of Chinook salmon populations in the Central Valley. Hence, sequential yearly impacts could be promulgated in future generations of the species.

As part of the Oroville Project FERC relicensing efforts, Reclamation's salmon mortality model was revised to include new spawning distribution and water temperature data, and more detailed Feather River reach segments. Simulated Chinook salmon early life stage survival estimates specific to the Feather River incorporate new data associated with: (1) temporal spawning and pre-spawning distributions; and (2) mean daily water temperature data in the Feather River.

This modeling approach estimates the percentages of Chinook salmon egg and alevin losses due to water temperature-induced mortality, based upon new pre-spawning and spawning temporal distributions derived from shifted smoothed carcass distributions, and from calculated mean daily water temperature data throughout the pre-spawning, spawning and incubation periods of Chinook salmon in the Feather River during the 2002/2003 spawning and incubation season. New pre-spawning, spawning and reach distributions were created to reflect the most recent (2002/2003) carcass survey data.

In former applications of Reclamation's salmon mortality model, monthly water temperature output was utilized by interpolating the monthly values into daily values. In this model, daily water temperature data were recorded from various locations on the Feather River for use as the input water temperature file. For additional information, refer to Oroville FERC Study Plan F-10 - Task 2C: Evaluate the timing, magnitude and frequency of water temperatures and their effects on Chinook salmon egg and alevin survival (DWR 2004c).

Three separate reviews of the NMFS October 2004 Biological Opinion on the Long-Term Central Valley Project and State Water Project OCAP (NMFS 2004) have been conducted to determine whether NMFS (2004) used the best available scientific and commercial information (California Bay-Delta Authority 2005; Maguire 2006; McMahon 2006).

McMahon (2006) acknowledged that a lack of information on how water operations related habitat alterations affect Central Valley salmonid populations exists. In this context, McMahon (2006) concluded that, *"…the BO appears to be based on best available information with regards to temperature effects on survival of salmonid embryos and early fry in the upper Sacramento River and major tributaries…"*.

Maguire (2006) reported two general concerns related to the salmon mortality model. First, Maguire (2006) stated, "The mean monthly temperature may in fact be of little predictive value for mortality estimation without knowing (using) the variability and duration of variability." Second, Maguire (2006) suggested that the salmon mortality model is of limited usefulness because it does not evaluate potential impacts on emergent fry, smolts, juvenile emigrants, or adults, and the model only considers water temperature as a source of mortality.

With respect to the application of the salmon early life stage mortality model in NMFS (2004), three concerns were reported within CBDA (2005). First, CBDA (2005) questioned the use of water temperature predictions that were developed by linear interpolation between monthly means without accounting for variation. Second, water temperature at the time of spawning was taken as an index of pre-spawning temperature exposure, which reportedly may be an unsatisfactory approach for spring-run Chinook salmon, which may hold in the river throughout the summer. Lastly, and reportedly the expert panel's most serious concern, "*…the data used to develop the relationships between temperature and mortality on eggs, alevins, and especially gametes was not the best available*."

To address these three concerns, the expert panel recommended that NMFS: (1) perform a thorough analysis of the data, relationships, and calculations of the salmon mortality model; (2) investigate how variation around monthly mean water temperatures would affect salmon mortality model results; and (3) suggest or make improvements to the model. It is uncertain whether NMFS will accept these recommendations and undertake these efforts to address the concerns raised with technical details of the salmon mortality model. At this time, this process has not been undertaken and salmon mortality model improvements have not been identified and incorporated into the model. Therefore, the existing salmon mortality model is the best available model for comparing the potential water temperature related effects of the Proposed Project/Action and alternatives on Chinook salmon early life stages to those of the bases of comparison.

10.2.1.4 ANALYTICAL APPROACH FOR EVALUATING FISHERIES AND AQUATIC RESOURCES IN THE DELTA

Hydrological modeling provides the technical foundation for assessing both potential beneficial and adverse impacts of CVP/SWP operations on fish species and their habitat within the Delta. The assessment relies on a comparative analysis of the simulated integrated operation of the CVP and SWP and resultant environmental conditions within the Delta under the bases of comparison, and the simulated operations and resultant environmental conditions predicted to occur in response to implementation of the Proposed Project/Action and alternatives. Operations associated with the Proposed Project/Action and alternatives have the potential to affect Delta fisheries resources by: (1) modifying habitat quality and availability for various fish species within the Delta; and (2) altering fish mortality resulting from State Water Project (SWP) and Central Valley Project (CVP) export operations from the south Delta.

The hydrological modeling output for each comparative scenario provides monthly data that are used as part of a general evaluation of potential impacts of project operations on habitat quality and availability for various species inhabiting the Bay-Delta estuary. Modeling results also can be used to estimate potential fish salvage, based upon historical estimates of fish density at both the CVP and SWP salvage facilities, for use as part of these impact analyses. Modeling parameters selected for part of this evaluation include:

- Location of the two-part per thousand salinity isohaline (X2);
- Delta outflow;

- Export-to-Inflow (E/I ratio); and
- Export pumping and fish salvage at CVP and SWP Delta facilities.[6]

As discussed in Section 10.1.4.1, the Resources Agency, DWR, and CDFG issued the Pelagic Fish Action Plan in March 2007. The Pelagic Fish Action Plan expanded upon the findings of the 2005 Delta Smelt Action Plan[7], and identified several proposed actions designed to address the POD that were based on the availability of more recent information and considered actions suggested by the Delta Smelt Working Group, the State Water Contractors, environmental groups and others. Related to the actions identified in the Pelagic Fish Action Plan, the Delta Smelt Working Group decided to moderate the flows in Old and Middle Rivers earlier this year. As of January 2007, DWR managed SWP water operations to maintain the upstream flow of Old and Middle rivers within the range of between 3,500 and 5,000 cfs (WWWCO website). Although the results of this experimental action are believed to be beneficial, new information may arise before January 2008 and prove otherwise, and further study is required to determine whether or not it will be deemed necessary in light of other changes to CVP/SWP operations in the Delta that are likely to occur in the years to come. Because the Old and Middle river actions that were implemented in 2007 are still preliminary and experimental, they were not used as impact indicators or significance criteria in this EIR/EIS. Depending on the outcome of other POD studies, these actions may be further refined or replaced if new information becomes available that indicates relationships between POD and explanatory variables. Nonetheless, a sensitivity analysis was conducted to compare combined Old and Middle River flows during January through June, consistent with the Pelagic Fish Action Plan and current existing condition considerations (see Section 10.1.4.1).

The USFWS, CDFG, NOAA and others have established biological relationships based upon results of fisheries investigations conducted for use in evaluating the biological impacts of changes in many of the habitat-related parameters that could be affected by implementation of the Proposed Project/Action or alternatives. Hence, findings of the impact assessment are based on a combination of established biological relationships, the best available scientific information on the life history periodicities and habitat requirements for various species, regulatory requirements, and interpretation of the results of hydrologic modeling analyses. Delta species of primary management concern include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, delta smelt, longfin smelt, American shad, striped bass, northern anchovy and starry flounder.

Reclamation determined in its OCAP BA that because the northern anchovy is primarily a marine species and integrated CVP/SWP operations have little impact on marine conditions, it is unlikely that changes in CVP/SWP operations would affect the northern anchovy. Reclamation also reported that there are no records of northern anchovy salvage at the CVP/SWP fish salvage facilities (Reclamation 2004). NMFS concurred with Reclamation's determination that the OCAP, and associated changes in integrated CVP/SWP operations, would not affect the EFH of northern anchovy (NMFS 2004). Accordingly, it is assumed that

[6] Estimated amounts of fish salvage at the CVP and SWP export pumping facilities, as a function of changes in the seasonal volumes of water diverted, is used as an indicator of potential impacts resulting from changes in water project operations. Currently, the impacts of export pumping on fish populations are difficult to quantify and, thus, estimated fish salvage at the export facilities is used as a substitute (Reclamation *et al.* 2004).

[7] In October 2005, the Resources Agency released the Delta Smelt Action Plan, which was a compilation of scientific research activities and studies to identify and understand the causes of the POD, and to identify other actions to benefit the species.

changes in integrated CVP/SWP operations resulting from the Project Alternatives would not affect the EFH of northern anchovy and, thus, no further analysis is required.

Although the starry flounder is primarily a marine species, it is estuarine dependent for a part of its life history and, thus, even though CVP/SWP operations have little impact on marine conditions, they can affect estuarine conditions in the Delta. High approach velocities, associated with the withdrawal of seawater, along the pumping plant intake structures can create unnatural conditions to the EFH utilized by starry flounder (Reclamation 2004). It is reported that various starry flounder life stages can be affected by export pumping operations, primarily through impingement and entrainment on the intake screens. Periods of low light (e.g., turbid waters, nocturnal periods) also may entrap adult and sub-adult fish (Reclamation 2004).

Starry flounder salvage occurs at the CVP and SWP export facilities and reportedly, most salvage occurs in May, June, and July (Reclamation 2004). Reclamation determined that the proposed OCAP could affect EFH of the starry founder in the Delta by changing flow and water quality. In the OCAP BA (2004), Reclamation also states that starry founder is a widespread species not directly targeted by commercial fisheries and impacts to starry flounder habitat are minor relative to starry flounder habitat as a whole and no commercial fisheries will be affected by localized impacts of the OCAP on the habitat or population (Reclamation 2004). NMFS determined that the OCAP would affect the EFH of starry founder because of the high numbers of starry flounder taken at the Delta pumping facilities. However, NMFS also stated in its OCAP BO (2004) that the measures recommended for improving screening and salvage efforts for fall-/late fall-run Chinook salmon also would benefit starry flounder. These measures include: (1) closing the Delta Cross Canal Gates from December 1 through June 15; (2) a plan to limit Jones Pumping Plant Exports to 4,600 cfs; and (3) renewal of the Jones Pumping Plant Mitigation Agreement between Reclamation and CDFG to offset unavoidable losses of Chinook salmon at the Tracy Fish Collection Facility (NMFS 2004). Due to the implementation of these measures and the limited impacts to starry founder habitat as a whole resulting from changes in CVP/SWP operations, it is assumed that the changes to the integrated CVP/SWP operations resulting from the Proposed Project/Action and alternatives would not affect the EFH of starry flounder and, thus, no further analysis is made in this EIR/EIS.

Potential impacts of the Proposed Project/Action and alternatives due to export pumping are not evaluated in this EIR/EIS for green sturgeon, longfin smelt, or American shad because salvage-density export relationships are not available for these species. Thus, for these fish species and other aquatic biological resources of the Delta, potential impacts of the Proposed Project/Action and alternatives are evaluated through examination of the modeled parameters discussed below.

Sacramento-San Joaquin Delta X2 Location

The SWRCB D-1641 requires the X2 location to meet certain objectives from February through June. The location of X2 within Suisun Bay during the February through June period is thought to be directly or indirectly related to the reproductive success and survival of the early life stages for several estuarine species. Results of statistical regression analysis suggest that abundances of several estuarine species are greater during the spring when the location of X2 is within the western portion of Suisun Bay (e.g., Roe Island [River Kilometer (RKm) 64]), with lower abundances correlated with those years when the location of X2 location is farther to the east near the confluence (RKm 81) of the Sacramento and San Joaquin rivers (Confluence) (YCWA *et al.* 2003). A location of X2 near Chipps Island (RKm 74) could result in a distribution pattern where more estuarine species would be susceptible to entrainment and elevated mortality in the central and south Delta due to predation or relatively high water temperatures. The standards related to the location of X2 in the 1995 Bay-Delta Plan and SWRCB D-1641 also are intended to protect Delta resources by providing adequate transport flows to move Delta fisheries away from the influence of the CVP/SWP water diversion facilities into low-salinity rearing habitat in Suisun Bay and the lower Sacramento River (USFWS 2004). Additionally, as discussed in Section 10.1.4.1, the Resources Agency, DWR, and CDFG issued the Pelagic Fish Action Plan in March 2007. The Pelagic Fish Action Plan identified water project operations to benefit delta pelagic fishes, including maintaining X2 west of Collinsville during May through December in wetter years (summer/fall).

Although the 1995 Bay-Delta Plan water quality objectives and SWRCB D-1641 requirements contain X2 objectives only for February through June, changes in monthly mean X2 locations are determined in this chapter for all months of each year because the Delta provides year-round habitat for one or more life stages of various species. The position of the low-salinity gradients affects the availability and quality of estuarine habitat, particularly during the late winter and spring months, which are thought to be important for survival and growth of a variety of fish and macroinvertebrate species. CALSIM modeling results are used to assess potential changes in monthly mean X2 movements associated with the Proposed Project/Action and alternatives, relative to the bases of comparison, and the resultant impacts on fish species of primary management concern in the Delta. CALSIM model output represents the location of the 2 ppt near-bottom salinity isohaline (i.e., X2), as calculated from the monthly average Net Delta Outflow Index (NDOI). Because the model represents the monthly mean X2 location, the day-to-day impacts of CVP/SWP operations are not shown in the modeling output representation.

For analytical purposes, separate X2 analyses are conducted for: (1) delta smelt and (2) other Delta fisheries resources of primary management concern, to account for differences in the analytical approaches taken in the OCAP BA/BOs, and because of differences in the availability of information regarding species specific life stage requirements, estuarine habitat utilization, vulnerability to impingement and entrainment at the Delta pumping facilities and other management objectives.

Analysis of X2 Location for Delta Smelt

The February through July period encompasses the peak delta smelt spawning period, and delta smelt larvae and juveniles are reported to be vulnerable to entrainment and elevated water temperatures from March through July. Upstream movements of X2 can cause delta smelt to become more susceptible to entrainment in the south Delta during March through July, and expose them to potentially lethal water temperatures during June through July (USFWS 2004).

Reclamation's analyses for delta smelt and other fish species in the OCAP BA (Reclamation 2004) compared the modeled X2 location during the months of February through June as a long-term average and average by water year type over the 72-year simulation period. Reclamation (Reclamation 2004) also analyzed the changes in the mean monthly position of X2 greater than one kilometer. Where differences in X2 location resulted in a shift from downstream of Chipps Island to upstream of Chipps Island between model cases, the analysis also determines whether X2 location in the succeeding month indicates a persistent shift upstream.

Reclamation (Reclamation 2004) also relied upon analyses that evaluated a 0.5 km change in the location of X2 during all water year types. Following review of the modeled data, certain water year types (e.g., wet, critical) may be able to be excluded from impacts consideration in this chapter, consistent with Reclamation (Reclamation 2004) and USFWS (2004). To illustrate, according to USFWS (USFWS 2004), in wet years "…*X2 is located in Suisun Bay throughout the modeled period. An upstream movement of 0.5 km in wet years would not significantly reduce habitat quality or quantity for delta smelt. In drier years, X2 is located upstream of the confluence of the Sacramento and San Joaquin rivers and the amount of quality habitat available to delta smelt is minimal and adult abundance is low (Bennett 2005). When X2 is located this far upstream, delta smelt would already be susceptible to increased mortality due to high temperatures, predation and entrainment. An upstream movement of X2 of 0.5 km would not be significant when it is located upstream of the confluence because delta smelt habitat is already poor and the upstream movement does not result in any substantial additional loss of habitat or increase in adverse effect."*

Because the OCAP BA and resultant BOs represent the best available information to date regarding the current operation of the CVP/SWP system, the Proposed Yuba Accord uses the same analytical approach for delta smelt as was undertaken by Reclamation and DWR in the OCAP BA and by USFWS in its OCAP BO. For this EIR/EIS, analyses compare changes in modeled X2 location during the months of February through July over the 72-year simulation period. Average X2 locations by water year type also are compared under the Proposed Project/Action and alternatives, relative to the bases of comparison. Additionally, the probabilities of occurrence of X2 location over the 72-year simulation period are presented as exceedance curves for the Proposed Project/Action and alternatives, and the bases of comparison. Positive differences between the Proposed Project/Action and alternatives and the bases of comparison represent an upstream movement of X2.

In the document titled "*Long-term Central Valley Project and State Water Project Operations Criteria and Plan Biological Assessment*", Reclamation (Reclamation 2004) states that "…*because there is presently no known basis for identifying a particular value as the critical one separating a detrimental X2 difference from an innocuous one, one kilometer was selected as a conservative (protective) criterion for review."* Consistent with Reclamation (Reclamation 2004), monthly mean movement of X2 of one kilometer or more is included as part of the Delta fisheries analysis in this document.

Changes in monthly mean X2 location from February through July under the Proposed Project/Action and alternatives, relative to the bases of comparison, are examined for the long-term average over the 72-year simulation period, and the average by water year type. When X2 location moves upstream by one kilometer or more, X2 shifts in the succeeding month also are evaluated for potential trends. Also, the number of occurrences in which X2 shifts of one kilometer or more in relation to the three compliance points (Roe Island,[8] Chipps Island, and the Confluence) are examined.

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[8] X2 standards at Port Chicago (i.e., Roe Island) are conditionally triggered only if the 14-day electrical conductivity is less than 2.64 mmhos/cm on the last day of the previous month (Reclamation 2004). Although X2 compliance at Roe Island is more sensitive to real-time "triggers" associated with daily and 14-day running average measurements of electrical conductivity (DWR and Reclamation 2001), CALSIM constraints (i.e., monthly time step) preclude a more accurate characterization of when these daily operational compliance requirements are in effect. However, evaluation of movements in X2 location past Roe Island are included in the impact analyses for the purposes of providing full disclosure and maintaining analytical rigor.

In addition, (DWR and Reclamation 2001) states that although the X2 compliance requirements at Port Chicago (i.e., Roe Island) are not in effect during critical water years when the SRI is less than 8.1 maf, it is in effect during other water year types. Therefore, X2 movements upstream of the Roe Island compliance point during critical water years would not be considered a significant impact.

Consistent with Reclamation (2004) and USFWS (2004), the number of occurrences of changes in X2 location of 0.5 km or more while X2 is located between Chipps Island and the Confluence under either comparative scenario, for all water year types, during the February through June period also is included as part of the delta smelt analysis in this EIR/EIS.

Analysis of X2 Location for Other Delta Fisheries Resources

Because many fish and macroinvertebrate species inhabit the Delta estuary year-round, while other species inhabit the estuary on a seasonal basis as a migratory corridor between upstream freshwater riverine habitat and coastal marine waters, as seasonal foraging habitat, or for reproduction and juvenile rearing, the Delta analysis in this EIR/EIS includes all months of the year and is inclusive of several species of primary management concern (i.e., Chinook salmon, steelhead, green sturgeon, starry flounder, northern anchovy, longfin smelt, American shad, and striped bass).

Although there are similarities in life stage timing and species specific estuarine habitat utilization reported in the literature, there are variations in run specific outmigration patterns for species such as Chinook salmon. To illustrate these variations, information on Chinook salmon outmigration periods, by run-type, from the NMFS OCAP BO is presented in greater detail. Although the winter-run Chinook salmon emigration period encompasses a portion of the months (i.e., January through April) in which X2 objectives are met, and may extend from September through June, winter-run Chinook salmon primarily migrate through the Delta from December through April (Reclamation 2004). The emigration period for spring-run Chinook salmon extends from November through early May (NMFS 2004) and also encompasses a portion (i.e., January through May) of the months when X2 objectives are met. Hallock (Hallock *et al.* 1961) found that juvenile steelhead in the Sacramento River Basin migrate downstream during most months of the year, but the peak emigration period occurs in the spring (NMFS 2004). Although juvenile winter-run Chinook salmon may be present in the Delta in February, they are not expected to be present during June. A relationship between juvenile salmon survival and X2 has been evaluated, but not established. In general, it is likely that conditions improve for salmonids as X2 moves westward in the Delta simply because the situation is indicative of greater outflow (NMFS 2004).

Because the OCAP BA and resultant BOs represent the best available information to date regarding the current operation of the CVP/SWP system, this EIR/EIS uses the same analytical approach as was undertaken by Reclamation and DWR in the OCAP BA and by NMFS in its OCAP BO. In addition to the analyses that were conducted in the OCAP BA/BOs for ESA purposes, the evaluation in this EIR/EIS includes several additional months, so that the analyses encompass all months of the year to account for state listed and recreationally important species in the Delta.

For this EIR/EIS, the analyses compare changes in long-term average X2 locations under the Proposed Project/Action and alternatives, relative to the bases of comparison, over the 72-year simulation period for all months of the year. X2 location also is evaluated by comparing the average by water year type under the Proposed Project/Action and alternatives, relative to the bases of comparison. Additionally, the probabilities of occurrence of X2 location over the 72-year simulation period are presented as exceedance curves for the Proposed Project/Action and alternatives, and the bases of comparison. Positive differences between the Proposed Project/Action and alternatives, and the basis of comparison represent upstream movements in the X2 location, while negative differences represent downstream movements in the X2 location.

Changes in monthly mean X2 location year-round under the Proposed Project/Action and alternatives, relative to the bases of comparison, are examined for the long-term average over the 72-year simulation period, and the average by water year type. When X2 location moves upstream by one kilometer or more, X2 shifts in the succeeding month also are evaluated for potential trends. Also, the number of occurrences in which X2 shifts of one kilometer or more in relation to the three compliance points (Roe Island,[9] Chipps Island, and the Confluence) are examined.

Sacramento-San Joaquin Delta Outflow

The 1995 Bay-Delta Plan also established Delta outflow objectives for all months of the year. The 1995 Bay-Delta Plan states that… "*Delta outflow objectives are included for the protection of estuarine habitat for anadromous fishes and other estuarine-dependent species*" (SWRCB 1995). Seasonal flows influence the transport of eggs and young organisms through the Delta and into San Francisco Bay. Flows during the months of April, May, and June play an especially important role in determining the reproductive success and survival of many estuarine species including salmon, striped bass, American shad, delta smelt, longfin smelt, splittail, and others (DWR and Reclamation 1996b). For the February though June period, Delta outflow objectives are met by compliance with the X2 objective. Potential impacts on delta smelt associated with changes in Delta outflow under the Proposed Project/Action and alternatives, relative to the bases of comparison, are assessed utilizing the X2 analyses.

Changes in Delta outflow may affect the availability and quality of estuarine habitat, particularly during the late winter and spring months, which are thought to be important for survival and growth of a variety of fish and macroinvertebrate species. In addition, the length of time juvenile Chinook salmon spend in the lower rivers and the Delta varies depending on the outflow, the times of year the salmon migrate, and the development stages of the fish (Kjelson *et al.* 1981). Residence time tends to be shorter during periods of high flow relative to periods of low flow. Analyses in this EIR/EIS include examination of long-term average monthly changes in Delta outflow over the 72-year simulation period, and monthly average changes by water year type for all months of the year under the Proposed Project/Action and alternatives, relative to the bases of comparison. Consistent with Reclamation (Reclamation 2004), the month of July is included in the Delta outflow analysis for delta smelt.

Sacramento-San Joaquin Delta Export-to-Inflow Ratio

The ratio between CVP and SWP exports and freshwater inflow to the Delta from the Sacramento and San Joaquin river systems (the E/I ratio) has been used to assess potential operational impacts on Bay-Delta habitat conditions, and the reported vulnerability of fish to

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[9] X2 standards at Port Chicago (i.e., Roe Island) are conditionally triggered only if the 14-day electrical conductivity is less than 2.64 mmhos/cm on the last day of the previous month (Reclamation 2004). Although X2 compliance at Roe Island is more sensitive to real-time "triggers" associated with daily and 14-day running average measurements of electrical conductivity (DWR and Reclamation 2001), CALSIM constraints (i.e., monthly time step) preclude a more accurate characterization of when these daily operational compliance requirements are in effect. However, evaluation of movements in X2 location past Roe Island are included in the impact analyses for the purposes of providing full disclosure and maintaining analytical rigor.

In addition, (DWR and Reclamation 2001) states that although the X2 compliance requirements at Port Chicago (i.e., Roe Island) are not in effect during critical water years when the SRI is less than 8.1 maf, they are in effect during other water year types. Therefore, X2 movements upstream of the Roe Island compliance point during critical water years would not be considered a significant impact.

salvage losses. Relationships between E/I ratios and resulting changes in biological response, such as abundance or geographic distribution, or increases in vulnerability to CVP or SWP salvage losses, have not been established. However, the framework for environmental analyses has typically assumed that the higher the ratio of export rate relative to freshwater inflow, on a seasonal basis, the higher the probability of adverse impacts on geographic distribution or salvage losses as a result of CVP and SWP export operations. E/I ratio limits specified in the 1995 Bay-Delta Plan and SWRCB D-1641 are intended to protect Delta resources by limiting their susceptibility to entrainment and elevated mortality in the Delta (**Table 10-4.**).

The Delta E/I ratio limits are built into the CALSIM modeling assumptions and, therefore, are consistently met under both the Proposed Project/Action and alternatives, and the bases of comparison during all months of the year. In addition, the E/I ratio impacts on pumping rates and Chinook salmon salvage and loss also are accounted for in the CALSIM modeling assumptions. Nevertheless, analyses in this document include examination of long-term average monthly changes in E/I ratios over the 72-year simulation period for delta smelt and other Delta fisheries resources.

Table 10-4. Delta Export/Inflow Ratio Limits

Time Period	Export/Inflow Ratio Limits
October - January	≤ 65%
February	35% (If January 8RI[10] ≥ 1.5 MAF) 35%-45% (If January 8RI is between 1.0 and 1.5 MAF 45% (If January 8RI ≤ 1.0 MAF)
March	≤ 35%
April 15 - May 16	≤ 35%
May 16 - June	≤ 35%
July - September	≤ 65%

Analysis of Export-to-Inflow Ratio for Delta Smelt (February through July)

Analyses include examination of long-term average monthly changes in E/I ratios over the 72–year simulation period, and monthly average changes by water year type for the February through July period under the Proposed Project/Action and alternatives, relative to the bases of comparison.

Analysis of Export-to-Inflow Ratio for Other Delta Fisheries Resources (Year-round)

Analyses include examination of long-term average monthly changes in E/I ratios over the 72–year simulation period, and monthly average changes by water year type for all months of the year under the Proposed Project/Action and alternatives, relative to the bases of comparison.

Salvage at the CVP/SWP Export Facilities in the Sacramento-San Joaquin Delta

The CVP and SWP export facilities that pump water from the Delta can directly affect fish mortality in the Delta through entrainment and associated stresses. Operations at the Tracy and John E. Skinner Fish Collection Facilities attempt to minimize the potential fisheries effects of the diversion, storage, and conveyance of water exported from the Delta via the CVP and SWP systems, respectively. Each facility consists of primary and secondary louver systems which

10 The term "8RI" refers to the eight river index which is the sum of the unimpaired forecast for: (1) Sacramento River at Bend Bridge; (2) Feather River at Oroville Reservoir; (3) Yuba River at Smartville; (4) American River at Folsom Lake; (5) Stanislaus River at New Melones Reservoir; (6) Tuolumne River at Don Pedro Reservoir; (7) Merced River at Exchequer Reservoir; and (8) San Joaquin River at Millerton Lake.

direct fish away from pumping facilities and safely concentrate them in holding tanks. Salvaged fish are then periodically transferred by truck to downstream release points in the Delta (DWR and Reclamation 1996a).

Salvage is used as an indicator of potential effects resulting from CVP and SWP export operations from the south Delta. Salvage estimates are defined as the numbers of fish entering the salvage facilities. Salvaged fish are subsequently returned to the Delta through a trucking and release operation. Because many species are sensitive to handling and trucking, which are often assumed to result in mortality, increased salvage is considered to be a potentially adverse effect, and decreased salvage is considered to be a potentially beneficial effect on Delta fisheries.

Fish salvage operations are conducted daily at the Tracy and Skinner fish facilities. As part of the salvage monitoring program for each facility, information is collected on species composition, length-frequency distribution for various species, and the occurrence of coded-wire tag (CWT) and other marked fish. Using a sub-sampling protocol, an expanded (or total) salvage estimate for each species is determined for each day at each of the fish salvage facilities using the methodologies described in NMFS (1993) and CDFG (1991a). Expansion of sub-sample estimates considers the following parameters: (1) species-specific sub-sampling count; (2) length of the sub-sampling period; and (3) length of the total daily pumping period.

Using the calculations described above, Reclamation compiled a dataset of fish salvage for both the Tracy and Skinner fish salvage facilities to be used during preparation of the 2004 OCAP BAs. The Reclamation dataset presents estimates for winter-run and spring-run Chinook salmon, steelhead, and delta smelt. The 11-year period of record for the Reclamation dataset extends from January 1993 through September 2003, and includes five wet water years, three above normal water years, two dry water years, and one critical water year. Using a monthly time-step, the dataset relates observed salvage values for each corresponding species and facility to the quantity of water pumped during a particular month, and results in an average monthly salvage density (e.g., fish salvaged per unit volume of water pumped). Due to the limited number of years in general, and specifically the limited number of relatively dry years utilized for the dataset, Reclamation pooled the wetter years (i.e., wet, above normal) and drier years (i.e., below normal, dry, critical), resulting in two separate salvage densities for each facility based on water year type. Salvage estimation used in this EIR/EIS is consistent with that methodology used in Reclamation's 2004 OCAP BAs.

Consistent with Reclamation's OCAP BAs, it is assumed that changes in salvage are directly proportional to changes in the amount of water pumped (e.g., doubling the amount of water exported doubles the number of fish salvaged). Hence, the assessment related to salvage illustrates potential effects by multiplying the species-specific monthly salvage densities by the percent change in the volume of water pumped during a particular time period and water year type at each facility, under the Proposed Project/Action and alternatives, relative to the bases of comparison. Average monthly export values are determined for each water year type utilizing model output data. The resulting values indicate the addition or reduction of fish expected to be salvaged at each export facility. The complete salvage calculation methodology is presented in Reclamation's OCAP BA (Reclamation 2004) and has been incorporated by reference.

Delta smelt salvage estimates are calculated using a similar methodology to that described above. However, Reclamation used the median (as opposed to the average) total Delta export at Banks and Jones to determine the change in delta smelt salvage under the Proposed Project/Action and alternatives, relative to the bases of comparison. Reclamation calculated the average delta smelt salvage densities for wetter and drier year types,[11] which was used to compute the predicted median difference in delta smelt salvage at the separate CVP and SWP facilities by multiplying mean salvage density by the median change in export pumping. The complete delta smelt salvage methodology is presented in Reclamation's OCAP BA (2004) and the USFWS OCAP BO (USFWS 2004), and is incorporated by reference.

Although Reclamation's 2004 OCAP consultation did not evaluate striped bass, the estimated striped bass salvage analysis utilizes a dataset provided by Reclamation consistent with the dataset used for the fish species analyzed in the OCAP BAs. The dataset includes 1993 through 2003 monthly salvage numbers for striped bass recovered at the CVP and SWP export facilities and was used to estimate salvage occurring under the bases of comparison and the Proposed Project/Action and alternatives by multiplying the monthly recorded salvage value by the percent change in the average Banks and Jones export expected to occur under each scenario. The same numerical analysis methods are employed for estimated striped bass salvage analysis as those described above.

10.2.1.5 APPLICATION OF HYDROLOGIC MODELING FOR ASSESSING POTENTIAL FISHERIES AND AQUATIC HABITAT IMPACTS

NEW BULLARDS BAR, OROVILLE, AND SAN LUIS RESERVOIRS

The methodologies used to analyze potential impacts on reservoir warmwater and coldwater fish species in Study Area reservoirs are discussed below.

Warmwater Fisheries

Because warmwater fish species of New Bullards Bar, Oroville, and San Luis reservoirs (including largemouth bass, smallmouth bass, spotted bass, green sunfish, bluegill, crappie, and catfish) use the warm upper layer of the reservoir and nearshore littoral habitats throughout most of the year, seasonal changes in reservoir storage, as it affects reservoir water surface elevation (feet msl), and the rates at which water surface elevation change during specific periods of the year, can directly affect the reservoir's warmwater fish. Reduced water surface elevations can potentially reduce the availability of nearshore littoral habitats used by warmwater fish for rearing, thereby potentially reducing rearing success and subsequent year-class strength. In addition, decreases in reservoir water surface elevation during the primary spawning period for warmwater fish nest building may result in reduced initial year-class strength through warmwater fish nest "dewatering." Given the differences in geography and altitude among the reservoirs within the area of analysis, warmwater fish spawning and rearing periods vary somewhat among reservoirs analyzed. Although black bass spawning may begin as early as February, or as late as May, in southern and northern California reservoirs, respectively, and may possibly extend to July in some waters, the majority of black bass and other centrarchid spawning in California occurs from March through May (Lee 1999; Moyle 2002). However, given the geographical and altitudinal variation among the CVP/SWP and non-Project reservoirs, in order to examine the potential of nest dewatering events to occur, the warmwater fish-spawning period is assumed to extend from March through June. Additionally, to encompass all reservoirs included in the Proposed Project/Action and

[11] Because Reclamation (2004) determined that there are too few years of most water year classes to reasonably estimate salvage density for each water year class, data for wet and above normal years and for below normal and drier water years were pooled.

alternatives, the period of April through November is appropriate for assessing impacts on warmwater juvenile fish rearing. For this analysis, the warmwater fish-spawning period is assumed to extend from March through June, and the warmwater fish-rearing period is assumed to extend from April through November. These periods encompass the majority, if not the entire, primary warmwater fish spawning and rearing period for the reservoirs included in this analysis.

To assess potential reservoir water surface elevation change-related impacts on the warmwater fish of reservoirs, the following approach was used. The magnitude of change (feet msl) in reservoir water surface elevation occurring each month of the primary spawning period for nest-building fish (March through June) under the Proposed Project/Action and alternatives were determined and compared to that modeled for the basis of comparison. Review of the available literature suggests that, on average, self-sustaining black bass populations in North America experience a nest success (i.e., the nest produces swim-up fry) rate of 60 percent (Friesen 1998; Goff 1986; Hunt and Annett 2002; Hurley 1975; Knotek and Orth 1998; Kramer and Smith 1962; Latta 1956; Lukas and Orth 1995; Neves 1975; Philipp *et al.* 1997; Raffetto *et al.* 1990; Ridgway and Shuter 1994; Steinhart 2004; Turner and MacCrimmon 1970).

A study by CDFG, which examined the relationship between reservoir water surface elevation fluctuation rates and nesting success for black bass, suggests that a reduction rate of approximately six feet per month or greater would result in 60 percent nest success for largemouth bass and smallmouth bass (Lee 1999). Therefore, a decrease in reservoir water surface elevation of six feet or more per month is selected as the threshold beyond which spawning success of nest-building, warmwater fish could potentially result in long-term population declines. To evaluate impacts on largemouth bass, smallmouth bass, and ultimately warmwater fish in general, the number of times that reservoir reductions of six feet or more per month could occur under the Proposed Project/Action and alternatives is compared to the number of occurrences that are modeled under the bases of comparison.

Criteria for reservoir water surface elevation increases (nest flooding events) have not been developed by CDFG. Because of overall reservoir fishery benefits (e.g., an increase in the availability of littoral habitat for warmwater fish rearing), greater reservoir elevations that would be associated with rising water levels would offset negative impacts due to nest flooding (Lee 1999). Therefore, the likelihood of spawning-related impacts from nest flooding is not addressed for reservoir fisheries.

Coldwater Fisheries

During the period when New Bullards Bar, Oroville, and San Luis reservoirs are thermally stratified (generally April through November), coldwater fish within the reservoir reside primarily within the reservoir's metalimnion and hypolimnion where water temperatures remain suitable. Reduced reservoir storage during this period could reduce the reservoir's coldwater pool volume, thereby reducing the quantity of habitat available to coldwater fish species during these months. Reservoir coldwater pool size generally decreases as reservoir storage decreases, although not always in direct proportion because of the influence of reservoir basin morphometry. Therefore, to assess potential storage-related impacts on coldwater fish habitat availability in New Bullards Bar, Oroville, and San Luis reservoirs, end-of-month storage modeled for each year of the 72-year simulation period under the Proposed Project/Action and alternatives are compared to end-of-month storage under the bases of comparison for each month of the April through November period. Substantial reductions in reservoir storage are considered to result in substantial reductions in coldwater pool volume and, therefore, in habitat availability for coldwater fish. Impacts on the coldwater fisheries are further assessed by determining whether seasonal changes in reservoir storage, and associated changes in water-surface elevation, would be expected to indirectly affect coldwater fish species by adversely affecting the productivity of their primary prey species (threadfin shad (*Dorosoma petenense*) and wakasagi (*Hypomesis hipponensis*)) were they occur.

LOWER YUBA RIVER

The Yuba River is utilized by a number of fish species of management concern. Changes in YCWA's management and operation of the Yuba River Development Project under the Proposed Project/Action and alternatives could potentially alter seasonal flows and water temperatures in the Yuba River, which in turn could affect the relative habitat availability for fish species that are present in the Yuba River. For these reasons, species-specific impact assessments are warranted for this river system and are conducted for the following species:

- Spring-run Chinook Salmon
- Fall-run Chinook Salmon
- Steelhead
- American Shad
- Striped Bass
- Other fish species of management concern, including Hardhead, River Lamprey, Sacramento Perch, and San Joaquin Roach
- Southern DPS of North American Green Sturgeon

For all runs of Chinook salmon[12] in the Yuba River, as well as for other fish species, the time periods for the evaluation of potential impacts on individual life stages are developed from an extensive review of the available literature. Species-specific flow and water temperature assessment methodologies for the Yuba River fisheries analyses are discussed below, as well as results from analyses of recent monitoring data that are incorporated into the Evaluation of Potential Impacts.

Analysis of Recent Monitoring Data

Summary of Recent Water Transfer Fisheries Monitoring Studies and Findings

The Yuba River is one of many Central Valley rivers that has been utilized in water transfer projects for a number of years. The following discussion provides a summary of YCWA's recent water transfers and related monitoring studies and evaluations performed in 2001, 2002, and 2004. Monitoring studies were not conducted in 2003, 2005 or 2006 because a research permit authorizing take of federally listed species, as required for monitoring by Section 10 of the federal ESA, was not issued in 2003, and because no substantial amounts of water were transferred in 2005 or 2006.

In 2001, the water transfers (172 TAF) occurred between approximately July 1, 2001 and October 14, 2001. Over a few days, flows increased by about 1,200 cfs and were generally sustained in the lower Yuba River through late August when ramp-down began.

The 2002 water transfers (157,050 AF), which occurred from mid-June through mid-September, did not have a definitive ramp-up period. Instead, the relatively high flows that occurred during spring were sustained until initiation of the water transfers. Relatively stable flows of approximately 1,200 to 1,400 cfs at the Marysville Gage were maintained through August 16,

[12] Although incidental use of the lower Yuba River by late-fall-run Chinook salmon might occur, late-fall-run Chinook salmon populations occur primarily in the Sacramento River (SWRCB 1994). Because only incidental use of the lower Yuba River by late-fall-run Chinook salmon is believed to occur, and because there is a paucity of information on such use, the fisheries evaluations in this EIR/EIS focus on the two Chinook salmon runs that are known to use the lower Yuba River (i.e., fall- and spring-run Chinook salmon).

2002. The ramp-down period associated with the water transfers began on August 17, 2002 and ended on September 16, 2002.

The 2004 water transfers (100,487 AF) also were characterized by a lack of a definitive ramp-up period. The relatively stable high June flows averaged 946 cfs at Marysville and were sustained through the initiation of the transfers (July 1) to August 28 at approximately 970 cfs at Marysville. Although the water transfers continued through September, a short ramp-down period occurred from August 28, 2004 through September 1, 2004, when flows at the Marysville gage were reduced from approximately 919 cfs to 531 cfs. Flows remained low and stable during the rest of September, averaging approximately 513 cfs.

The primary fisheries issues evaluated in recent water transfer monitoring and evaluation studies include issues associated with: (1) juvenile steelhead downstream movement; (2) adult Chinook salmon immigration and the potential for increased straying of non-native fish into the lower Yuba River; and (3) water temperatures in the lower Yuba River and Feather River.

The initial observations and reported findings of the monitoring and evaluation studies undertaken during 2001, 2002, and 2004 are summarized below.

JUVENILE STEELHEAD NON-VOLITIONAL DOWNSTREAM MOVEMENT

Resource agencies involved in the management of fisheries resources in the lower Yuba River have previously indicated concern regarding the downstream movement of juvenile steelhead due to increases in instream flows associated with water transfer operations. The potential movement of juvenile steelhead over Daguerre Point Dam (RM 11) could restrict subsequent rearing to those areas downstream of Daguerre Point Dam, because juvenile steelhead may not be able to readily pass back upstream of Daguerre Point Dam. Conditions downstream of Daguerre Point Dam may be more or less suitable for juvenile steelhead rearing during the post-water transfer period, depending upon several factors, including post-water transfer water temperatures as influenced by ambient conditions.

The 2001 water transfer was characterized by a relatively large, rapid ramp-up period. Beginning approximately July 1, 2001, water transfers increased flows in the lower Yuba River over a few days by about 1,200 cfs and generally were sustained through late August when ramping down began. On July 8, 2001, a week subsequent to the start of the 2001 water transfers, the daily catch at the CDFG Hallwood Boulevard (RM 7) RST increased from less than ten YOY steelhead juveniles per day, to more than 450 YOY per day (CDFG unpublished data). The next week, daily catches decreased to about 190 YOY per day. In the following weeks, while the transfers were continuing, daily catches decreased further, but still surpassed catches prior to the water transfers. Thus, potentially associated with the ramping-up of the 2001 water transfers, juvenile steelhead moved downstream from the upstream reaches of the lower Yuba River to areas downstream of Hallwood Boulevard. The relationship between a rapid increase in flow and a large peak in the number of juvenile steelhead captured at the RSTs may indicate that the water transfer affected downstream movement of juvenile steelhead, possibly over Daguerre Point Dam into the lower Yuba River, or into the lower Feather River.

In response to the 2001 water transfer observations, discussions regarding flow and water temperature patterns and coincident fish behavior, including juvenile steelhead downstream movement, YCWA, NMFS, USFWS, CDFG, and NGO representatives collaboratively developed a rigorous monitoring and evaluation plan for YCWA water transfers. Additionally, these entities created an instream flow release schedule for the water transfers to avoid a rapid increase in flow when the transfers begin to minimize or avoid impacts upon anadromous fish in the lower Yuba River.

During the 2002 and 2004 water transfers, YCWA operated the Yuba Project in a manner that maintained instream flows in the lower Yuba River at a relatively stable rate in the late spring, with gradual changes in flow rates through initiation of the water transfer. Maintenance of more stable and gradually changing flows during this period (June through July), rather than a large, rapid ramp-up such as occurred during the 2001 water transfer, appeared to minimize the potential for transfer-related inducement of juvenile salmonid downstream movement.

Monitoring data (RST catch data) for 2002 and 2004 water transfers indicate that the large peak in downstream movement of juvenile steelhead observed in 2001 did not occur in 2002 or 2004. The RST catch data from the 2002 water transfers do not suggest an association between the initiation of the water transfers and the downstream movement of juvenile steelhead. This information suggests that a large increase in the numbers of juvenile steelhead moving downstream such as that which occurred at the initiation of the 2001 transfers may be avoided by maintaining a more gradual increase in flows through the initiation of water transfers. Downstream movement of juvenile steelhead during the water transfers may be associated with the rate of flow increase from the water transfer, rather than the eventual maximum flow or a response to water temperature change. In 2004, neither the RST catch data nor the estimated abundances suggest an association between the initiation of the water transfers and the downstream movement of juvenile steelhead.

In summary, water transfer monitoring in 2001, 2002, and 2004 indicate that the character of the initiation of the water transfers potentially can affect juvenile steelhead downstream movement. In 2001, an increase in the number of downstream moving juvenile steelhead was observed coincident with the relatively rapid and large increase in stream flow at the onset of the water transfer. However, in 2002 and 2004, when increases in stream flow during the initiation of the water transfers were relatively small and gradual, increases in the numbers of downstream moving juvenile steelhead were not observed. Based upon the substantial differences in juvenile steelhead downstream movements (RST catch data) noted between the 2001 study, and the 2002 and 2004 studies, it is apparent that the increases in juvenile steelhead downstream movement associated with the initiation of the 2001 water transfers were avoided due to a more gradual ramping-up of flows that occurred in 2002 and 2004.

Under the Proposed Project/Action, flow ramp-ups in the lower Yuba River at the Marysville Gage may occur during July or August as parts of supplemental surface water or groundwater transfers, or because of changes in Yuba Project operations that are necessary so that storage in New Bullards Bar Reservoir meets the September 30 target of 650 TAF.

In sections 5.1.7 and 5.1.8 of the Fisheries Agreement, YCWA will commit to specific terms and conditions governing the changes in lower Yuba River flows, from the peak spring flow period through the June period into the summer water transfer period, that are associated with supplemental surface water and groundwater transfers. These terms and conditions will vary by flow schedule, and generally will have the net effect of reducing or eliminating the ramp-ups that otherwise would occur with supplemental surface water or groundwater transfers.

If YCWA makes any supplemental surface water transfer, then, under Section 5.1.7 of the Fisheries Agreement, YCWA will make the same amount of water available for supplemental instream flows in the lower Yuba River, and this water will be released on a schedule set by the RMT. For example, if YCWA makes a supplemental surface water transfer of 10 TAF, then YCWA will make an additional 10 TAF available for supplemental instream flows in the lower

Yuba River during the same calendar year. This volume of water that will be allocated for RMT dispatch normally will be sufficient to avoid any substantial ramp-up between the June flows and the July and August flows associated with the supplemental surface water transfer.

For supplemental groundwater transfers, Section 5.1.8 of the Fisheries Agreement will provide that no ramp-up will be permitted during Schedule 1 years between the end of the high spring flow portion of the schedule (June) and the commencement of supplemental groundwater transfer (July). During Schedule 2 through 5 years, specific blocks of water, proportionally sized for the volume of the planned supplemental groundwater transfer, will be made available to the RMT for dispatch between the end of high spring flows and the commencement of supplemental groundwater transfer. During Schedule 6 years, the schedule for the flows for any supplemental groundwater transfers will be developed in consultation with the RMT and set to achieve the maximum fish benefit during the transfer period. The volumes of water that will be allocated for RMT dispatch normally will be sufficient to avoid any substantial ramp-ups between the June flows and the July and August flows associated with any supplemental groundwater transfer.

For Yuba Project operations to meet the September 30 storage target of 650 TAF, YCWA will consult with the RMT each year and review available data regarding non-volitional movements of juvenile steelhead, and then develop a flow schedule that will avoid any ramp-ups that would be likely to cause any such non-volitional movement.

For these reasons, the Proposed Project/Action is not anticipated to contain any ramp-up rates that would induce non-volitional downstream movement of juvenile steelhead.

For impact assessment purposes, it is assumed that the bases of comparison will have similar flow ramp-up rates to those for the Proposed Project/Action. Thus, although the daily ramp-up rates are not included in the outputs of the monthly hydrologic assessment model, the restrictions under the Proposed Project/Action would provide an equivalent level of protection against the non-volitional downstream movement of juvenile steelhead in the lower Yuba River to that which would occur under the other scenarios evaluated in this EIR/EIS. Therefore, additional analysis of flow ramp-ups on the non-volitional downstream movement of juvenile steelhead is not necessary in the evaluation of the Proposed Project/Action and alternatives.

ATTRACTION OF NON-NATAL ADULT CHINOOK SALMON IN THE LOWER YUBA RIVER

In the past, hypotheses have been suggested regarding the potential relationships between the water transfers and the relative abundance of adipose fin-clipped and non-adipose fin-clipped immigrating adult Chinook salmon. Specifically, concern has been raised regarding the potential for the Yuba River water transfers via decreased water temperatures and increased flow, relative to the Feather River, to encourage the straying of Feather River hatchery Chinook salmon into the Yuba River. YCWA and CDFG monitoring efforts in 2001, 2002, and 2004 water transfer years indicated that Chinook salmon of hatchery origin ascended the fish ladders at Daguerre Point Dam in the lower Yuba River during both the water transfer and non-transfer periods. Chinook salmon of hatchery origin also have been observed ascending the Yuba River in non-transfer years (CDFG unpublished data).

Adult Chinook salmon monitoring (adult ladder trapping) during 2001 was not sufficient to provide a database that could be statistically analyzed. Although the 2002 data were statistically analyzed, a number of unexpected procedural difficulties were encountered during the 2002 study implementation leading to unequal distribution of sampling effort at the fish ladders and low number of sampling days representing the water transfer study period (i.e., less than 15 percent of the study period). These issues, combined with the incorrect assumption that salmon counts before, during and after the water transfers were distributed as Poisson variables with constant but distinct rates[13], likely lead to underestimation of adult Chinook salmon abundance. However, despite the procedural difficulties and low reliability of the resulting abundance estimates, the 2002 study led to three general observations.

- The temporal distribution of the adult Chinook salmon catch was more likely a reflection of the adult immigration life stage periodicity expected for spring-run and fall-run Chinook salmon, rather than an association with flows or water temperatures.
- Relatively high water transfer flows did not attract salmon immigrants because otherwise a greater number of immigrating non-adipose fin-clipped adult Chinook salmon would have been observed during the transfer period, relative to the pre- and post-transfer periods.
- The estimates of the proportions of adipose fin-clipped adult Chinook salmon to the total number of adult Chinook salmon immigrating into the lower Yuba River before, during and after the 2002 water transfers did not indicate the attraction of non-natal (adipose fin-clipped) adult Chinook salmon during the transfer period.

In June 2003, the VAKI Riverwatcher system, an infrared detection device, as well as a video recorder, together used to classify and enumerate adult fish, was installed at the Daguerre Point Dam fish ladders. During the 2004 study period (May 1 through September 30, 2004), the VAKI system was utilized to monitor migration pattern and abundance estimates of adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon immigrating into the lower Yuba River before, during and after the 2004 water transfer. The use of the VAKI system as a counting device, and CDFG's processing of the resulting VAKI counts, photographs, and silhouettes enabled a more efficient and reliable collection of data than in previous years. The data were used to obtain estimates of the immigration rates (fish/day), abundance estimates of adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon, and proportions of adipose fin-clipped adult Chinook salmon. The resulting data set permitted intense statistical evaluation including Chi-square analysis, multiple regression analysis and multivariate time series analysis, providing a more thorough assessment of the potential effects of the 2004 water transfer on the immigration of Chinook salmon into the lower Yuba River, and of the relationship between Chinook salmon immigration and Yuba River flows and water temperatures, relative to the Feather River, than could be performed in previous years. The findings of these analyses led to the following general conclusions.

- The temporal distributions of the daily counts of adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon likely were reflections of Chinook salmon adult immigration life stage periodicity, with the relatively abundant fall-run Chinook salmon mostly migrating during the post-transfer period.
- As the 2004 study period progressed, more adipose fin-clipped and non-adipose fin-clipped Chinook salmon were observed immigrating into the Yuba River, but not necessarily resulting from an attraction to the cooler waters of the lower Yuba River, or to a relative increase in Yuba River flows with respect to the Feather River flows. The

[13] A Chi-square analysis indicated that during the 2004 survey, neither the adipose fin-clipped or the non-adipose fin-clipped Chinook salmon migrated with constant but distinct rates for the pre-transfer, transfer, and post-transfer periods, suggesting that the assumption that salmon counts before, during and after the water transfers were distributed as Poisson variables with constant but distinct rates, that was used to estimate the 2002 abundance of adipose fin-clipped and non-adipose fin-clipped Chinook salmon, probably was incorrect.

2004 abundance estimates and immigration rates for adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon suggest that the relatively high flows and low water temperatures observed during the transfer period did not necessarily attract salmon immigrants; otherwise, greater abundances and immigration rates would have been observed during the transfer period relative to the pre- and post-transfer periods.

- The estimates of the proportions of clipped adult Chinook salmon to the total number of adult Chinook salmon immigrating into the lower Yuba River did not suggest the attraction of non-natal adult Chinook salmon during the 2004 transfer period, because the proportion calculated for the transfer period was not greater than the proportions for the pre-transfer and post-transfer periods.
- Multivariate time series analyses indicate that the immigration rates of non-adipose fin clipped and adipose-fin clipped Chinook salmon in 2004 were not significantly associated with: (1) attraction flows, defined as the difference between Yuba River and Feather River flows; or (2) attraction water temperatures, defined as the difference between Yuba River and Feather River water temperatures.

Analyses of the best available information (i.e., 2002 and 2004 water transfers studies data) indicate that flow patterns that do not involve a large, rapid ramp-up, and that are characterized by relatively high and stable flows during July and August, do not appear to attract non-natal adult Chinook salmon into the Yuba River. Under the Proposed Project/Action, a pronounced ramp-up will not occur, as discussed above (see the Juvenile Steelhead Non-volitional Downstream Movement discussion).

For impact assessment purposes, it is assumed that the bases of comparison will have similar flow ramp-up rates to those for the Proposed Project/Action. Thus, although the daily ramp-up rates are not included in the outputs of the monthly hydrologic assessment model, the restrictions under the Proposed Project/Action would provide an equivalent or higher level of protection against the attraction of non-natal adult Chinook salmon in the lower Yuba River than would occur under the other scenarios evaluated in this EIR/EIS. Therefore, additional analysis of flow ramp-ups on the attraction of non-natal adult Chinook salmon is not necessary in the evaluation of the Proposed Project/Action and alternatives.

Summary of CDFG Chinook Salmon Emigration Monitoring Studies

CDFG has conducted juvenile salmonid outmigration monitoring by operating rotary screw traps (RSTs) in the lower Yuba River near Hallwood Boulevard, located approximately 6 RM upstream from the city of Marysville. CDFG's RST monitoring efforts generally extend from fall (October or November) through winter, and either into spring (June) or through the summer (September) annually from 1999 to present. The objectives of the RST sampling are to develop baseline information determine and document species and race composition, the timing of downstream movement below the spawning area, duration of downstream movement, and the condition and size of downstream migrants, and to address survival.

Data from CDFG RST monitoring are available for 1999/2000, 2000/2001, 2001/2002, 2003/2004, and 2004/2005. Analyses of available RST data indicate:

- Most Chinook salmon juveniles move downstream past the Hallwood Boulevard location prior to May of each year. For the 5 years of data included in the analyses, 97.5 to 99.2 percent of the total numbers of juvenile Chinook salmon were captured by May 1 of each year. The percentage of the total juvenile Chinook salmon catch moving downstream past the Hallwood Boulevard location each year ranged from 0.4 to 1.3 percent during May, and 0 to 1.2 percent during June.

- Overall, most (83.8 percent) of the juvenile Chinook salmon were captured at the Hallwood Boulevard RSTs soon after emergence from November through February, with relatively small numbers continuing to be captured through June.
- In general, captures of post-emergent Chinook salmon individuals did not appear to be associated with flow. Rather, post-emergent juvenile Chinook salmon consistently were captured primarily from November through February regardless of flow conditions.
- Captures of (over-summer) holdover juvenile Chinook salmon ranging from about 70 to 140 mm FL, although not numerous, primarily occurred from October through January, with a few individuals captured into March.
- For those juvenile Chinook salmon captured in the Hallwood Boulevard RST each year from March 1 through June, examination of the data indicates that the time of emigration may be positively related to flow. The date of the median catch of juvenile Chinook salmon for this period is positively correlated ($r = 0.78$, $p = 0.12$) with median flow through that date. In other words, the available data indicate that the lower the flow during the spring period, the earlier the time of juvenile Chinook salmon emigration.

For the sampling periods of 2001/2002, 2003/2004, and 2004/2005, CDFG identified specific runs based on sub-samples of lengths of all juvenile Chinook salmon captured in the RSTs by using the length-at-time tables developed by Fisher (1992), as modified by Sheila Green, DWR. Although the veracity of utilization of the length-at-time tables in the Yuba River has not been ascertained, based on the examination of run-specific determinations, in the lower Yuba River the vast majority (93.6 percent) of spring-run Chinook salmon emigrate as post-emergent fry during November and December, with a relatively small percentage (6.3 percent) of individuals remaining in the lower Yuba River and emigrating as YOY from January through March. Only 0.6 percent of the juvenile Chinook salmon identified as spring-run was captured during April, 0.1 percent during May, and none were captured during June.

NMFS (2002a) reported that in Deer and Mill creeks, during most years juvenile spring-run Chinook salmon spend 9 – 10 months in the streams, although some may spend as long as 18 months in freshwater. Most of these "yearling" spring-run Chinook salmon move downstream in the first high flows of the winter from November through January (CDFG 1998; USFWS 1995d). Juvenile spring-run Chinook salmon typically emigrate from Butte and Big Chico creeks soon after emergence during December and January, while some remain throughout the summer and exit the following fall as yearlings (NMFS 2002a). The above summary of juvenile Chinook salmon emigration monitoring studies in the Yuba River is most consistent with the temporal trends of spring-run Chinook salmon outmigration reported for Butte and Big Chico creeks.

It has been previously suggested that spring-run Chinook salmon smolt emigration generally occurs from November through June in the lower Yuba River (CALFED and YCWA 2005; CDFG 1998; SWRI 2002). CDFG's recent RST monitoring data indicate that spring-run juvenile Chinook salmon in the lower Yuba River primarily may not outmigrate as smolts, but rather as juveniles. For impact evaluation purposes, emphasis is placed on the November through April juvenile emigration period, although changes in flows and water temperatures are evaluated over the previously suggested entire November through June smolt emigration period.

CDFG also employed the run identification methodology for the years described above to identify fall-run Chinook salmon juveniles captured in the RSTs. Based on the examination of run-specific determinations, in the lower Yuba River the majority (81.1 percent) of fall-run Chinook salmon move past the Hallwood Boulevard RST from December through March, with decreasing numbers captured during April (8.9 percent), May (6.6 percent), June (3.2 percent), and July (0.2 percent). Most of the fish captured from December through March were post-emergent fry (< 50 mm FL), while nearly all juvenile fall-run Chinook salmon captured from May through July were larger YOY (≥ 50 mm FL).

Adult Upstream Passage and Holding

Critical Riffles

CDFG (1991a) reported a study to determine if low flows impaired upstream migration and distribution of spawning fall-run Chinook salmon in the lower Yuba River. To assess conditions of upstream migration, naturally occurring critical riffles were identified. In the study, CDFG represented critical riffles by IFIM transects located at the Simpson Lane and Daguerre Point Dam IFIM transect sites. Depths were measured along two of these transects at flow rates of 35 cfs at Daguerre Point Dam and 84 cfs near Simpson Lane. PHABSIM was used to simulate water surface elevations related to discharge levels at other flows.

Although minimum depth criteria for upstream migration of adult Chinook salmon vary in the literature, CDFG chose criteria based on a minimum depth of 0.8 feet, which must cover continuously 10 percent of the transect, and a total of 25 percent of the transect, non-continuously (Thompson 1972).

Using these depth criteria, CDFG (1991a) concluded that Transect 1 at Simpson Lane, a critical riffle, posed the greatest potential impairment to adult Chinook salmon upstream migration. Extrapolation of the Simpson Lane IFIM Transect 1 data indicates that a "minimum of approximately 175 cfs are required" to meet Thompson's (1972) criteria. CDFG (1991a) concluded that "…stream flows in excess of 100 cfs are necessary to provide minimum upstream passage for adult Chinook salmon at all locations along the lower Yuba River downstream of Daguerre Point Dam."

For Chinook salmon, the establishment of 175 cfs as the flow rate required for critical riffle passage may be overly rigorous, because of the criteria chosen by CDFG. Moreover, these criteria are not consistent with critical riffle passage criteria more recently established by CDFG to protect anadromous salmonids.

In January 1998 PG&E, CDFG, USFWS, and NMFS, collectively referred to as the Potter Valley Project Fishery Review Group, or FRG, reached joint agreement on a recommendation for modifications to the project's flow schedule, operations, and facilities (NMFS 2000). In consideration of anadromous salmonids (including Chinook salmon and steelhead), the FRG agreed-upon critical riffle passage "standard" was the provision of a water depth of 0.6 feet for a width of four continuous feet in the Eel River, California.

CDFG's thalweg analysis (CDFG 1991a) demonstrates that a depth of approximately 0.8 feet would be provided for a cross-sectional distance of up to approximately 40 continuous feet at a flow of about 80 cfs. Thus, a flow of 175 cfs probably substantially exceeds the flow required to provide critical riffle passage in the lower Yuba River.

Therefore, for the purposes of this impact assessment, an evaluation of the frequency of flows occurring below 80 cfs under each alternative is conducted to assess potential flow-related impacts of the Proposed Project/Action and alternatives on adult salmonid upstream critical riffle passage below Daguerre Point Dam.

Daguerre Point Dam

Daguerre Point Dam's fish ladders are considered to be suboptimally designed. Specifically, sheet flow across the dam's spillway, particularly during high-flow periods, may obscure ladder entrances and, thus, makes it difficult for immigrating adult salmonids to find the entrances. Fall-run Chinook salmon have been observed attempting to leap over the dam, demonstrating that these fish may have difficulty in finding the fish ladder entrances (Corps 2001). Both ladders, particularly the south ladder, tend to clog with woody debris and debris from gravel buildup, which can block passage or substantially reduce attraction flows at the ladder entrances. The north and south ladders exits are close to the spillway, potentially resulting in adult fish exiting the ladder being immediately swept by flow back over the dam. The Corps past operational criteria required that the ladders be physically closed when water elevations reached 130, or when flows were slightly less than 10,000 cfs (SWRCB 2003), and to keep them closed until the water recedes to an elevation of 127 feet (CALFED and YCWA 2005).

The Corps is collaborating with resource agencies to improve fish passage by keeping the ladders open at water elevations higher than 130 feet, and reopening the ladders before the water elevation recedes to 127 feet. Additionally, the Corps, working with CDFG, is implementing conservation measures to maintain the two fish ladders by clearing debris when needed. In 2000, the Corps dredged the sediment immediately upstream of the north fish ladder exit as a conservation measure to provide improved fish passage (NMFS 2002a). The Anadromous Fish Restoration Program (AFRP) funded the Corps to investigate alternatives to improve fish passage at Daguerre Point Dam. The Corps is currently the federal lead agency in a feasibility study and EIS/EIR for fish passage improvement at the dam. DWR is the state lead agency for the CEQA process on this project (CALFED and YCWA 2005).

For the purposes of this impact assessment, an evaluation of the frequency of flows occurring above 10,000 cfs under each alternative is conducted to assess potential flow-related impacts of the Proposed Project/Action and alternatives on immigrating adult salmonids.

Holding Habitat

Adult Chinook salmon prefer to hold in run and pool habitats during their upstream migration to spawning areas. Preferred holding water depths for these habitats are usually greater than 6.2 feet (Moyle 2002). In the lower Yuba River, adult spring-run Chinook salmon apparently hold over the summer in the deep pools and cool water downstream of the Narrows I and Narrows II powerhouses, or further downstream in the Narrows Reach (SWRCB 2003), where water depths can exceed 40 feet.

The stage-discharge relationship at Smartville is applied to hydrologic model flow results to aid in determining potential flow-related impacts on adult spring-run Chinook salmon holding habitat above Daguerre Point Dam. The stage-discharge relationship was obtained from the California Data Exchange Center website (CDEC) in the form of a rating table to determine stage elevation associated with a specific discharge. When modeled flows occurred between two discharges in the rating table, linear interpolation was used to determine the stage to the nearest 0.01 feet associated with each modeled flow. Because changes in stage as small as 0.01

feet would be difficult to measure and would not have any biological meaning, stages utilized for analyses were rounded to the nearest tenth of a foot (0.1 feet). Long-term average stage and average stage by water year type were calculated from mean monthly stages for each water year, rather than converting long-term average flow and average flow by water year type to stage.

Stage differences associated with the Proposed Project/Action and alternatives that are greater than or equal to one foot are evaluated further. For purposes of this analysis, the frequency of stage differences greater than or equal to one foot during the spring-run Chinook salmon March through October holding period serve as an evaluation guideline for comparative purposes.

Potential Redd Dewatering and Juvenile Stranding

The timing, magnitude and frequency of flow reduction and fluctuation events have the potential to influence the condition and production of salmonids in the lower Yuba River. The potential problem of flow fluctuations and redd dewatering was recognized in the early 1960s. In 1965, CDFG and YCWA entered into an agreement addressing flow fluctuations in the lower Yuba River. The 1965 CDFG/YCWA Agreement and the 1966 FPA license placed limits on the magnitude and rate of controlled flow reductions at the Smartville Gage during October and November. Except for flow reductions and fluctuations caused by emergency operations at Narrows II Powerhouse, these limits generally have been effective in protecting fall- and spring-run Chinook salmon redds from dewatering (SWRCB 1994).

Revised flow reduction and fluctuation criteria for the lower Yuba River were established in the 2005 FERC Order Modifying and Approving Amendment of License for the Yuba River Development Project (FERC No. 2246). The revised flow reduction and fluctuation criteria were developed to be more protective of juvenile salmonids from stranding and of salmonid redds from dewatering than previous requirements. The following conditions stipulated in the FERC Order were developed to protect salmonid redds from dewatering (FERC 2005):

- Project releases or bypasses that reduce stream flow downstream of Englebright Dam shall be gradual and, over the course of any 24-hour period, shall not be reduced below 70 percent of the prior day's average flow release or bypass flow.
- Once the daily project release or bypass level is achieved, fluctuations in the stream flow level downstream of Englebright Dam due to changes in project operations shall not vary up or down by more than 15 percent of the average daily flow.
- During the period from September 15 to October 31, YCWA shall not reduce the flow downstream of Englebright Dam to less than 55 percent of the maximum five-day average release or bypass level that has occurred during that September 15 to October 31 period or the minimum stream flow requirement that would otherwise apply, whichever is greater.
- During the period from November 1 to March 31, YCWA shall not reduce the flow downstream of Englebright Dam to less than the minimum stream flow release or bypass established for the September 15 through the October 31 time period; or 65 percent of the maximum five-day average flow release or bypass that has occurred during the November 1 to March 31 period; or the minimum stream flow requirement that would otherwise apply, whichever is greater.

Additional detail is provided in the 2005 FERC Order (FERC 2005). The National Marine Fisheries Service issued a BO (2005b) that included the flow reduction and fluctuation criteria in the 2005 FERC Order as reasonable and prudent measures.

Because changes in instream flow releases to the lower Yuba River are governed by the above-described flow reduction and fluctuation criteria, and these criteria apply to all alternatives and bases of comparison, additional analyses of flow effects on juvenile fish stranding and redd dewatering are not necessary in the evaluation of the Proposed Project/Action and alternatives.

Spring-run Chinook Salmon

To assess potential flow-related impacts of the Proposed Project/Action and alternatives on spring-run Chinook salmon, the following parameters are evaluated: (1) long-term average flows; (2) average flow by water year type; (3) the cumulative probability distribution of flows; (4) the one-to-one flow relationship (i.e., flows that would occur under the Proposed Project/Action and alternatives, and the bases of comparison during the same month and year); and (5) relationships between spawning habitat availability and discharge. Comparisons are conducted for each of the following life stages, life stage periodicities, and modeled locations:

- Adult immigration and holding (March through October - Smartville and Marysville);
- Adult spawning (September through November - upstream of Daguerre Point Dam);
- Juvenile rearing (Year-round - Smartville and Marysville); and
- Smolt emigration (November through June - Smartville and Marysville).

Potential water temperature-related impacts on spring-run Chinook salmon are evaluated through assessments which focus on the life stages and the respective life stage periodicities described above, with the addition of embryo incubation, which extends from September through March. To assess potential water temperature-related impacts of the Proposed Project/Action and alternatives on spring-run Chinook salmon, the following parameters are evaluated: (1) long-term average water temperatures; (2) average water temperatures by water year type; (3) the cumulative probability distribution of water temperatures; and (4) the one-to-one relationship of water temperatures at Smartville, Daguerre Point Dam and Marysville.

Fall-run Chinook Salmon

To assess potential flow-related impacts of the Proposed Project/Action and alternatives on fall-run Chinook salmon, the same parameters described above for spring-run Chinook salmon are evaluated for the following life stages, life stage periodicities, and locations:

- Adult immigration and holding (August through November - Smartville and Marysville);
- Adult spawning (October through December - Smartville and Marysville); and
- Juvenile rearing and outmigration (December through June - Smartville and Marysville).

Potential water temperature-related impacts on fall-run Chinook salmon are evaluated through assessments which focus on the life stages and the respective life stage periodicities described above, with the addition of embryo incubation, which extends from October through March. To assess potential water temperature-related impacts of the Proposed Project/Action and alternatives on fall-run Chinook salmon, the following parameters are evaluated: (1) long-term average water temperatures; (2) average water temperatures by water year type; (3) the cumulative probability distribution of water temperatures; and (4) the one-to-one relationship of water temperatures at Smartville, Daguerre Point Dam and Marysville.

Steelhead

To assess potential flow-related impacts of the Proposed Project/Action and alternatives on steelhead, the same parameters described above for spring-run Chinook salmon are evaluated for the following life stages, life stage periodicities, and locations:

- Adult immigration and holding (August through March - Smartville and Marysville);
- Adult spawning (January through April - Smartville and Marysville);
- Juvenile rearing (Year-round - Smartville and Marysville); and
- Smolt emigration (October through May - Smartville and Marysville).

Potential water temperature-related impacts on steelhead are evaluated through assessments which focus on the life stages and the respective life stage periodicities described above, with the addition of embryo incubation, which extends from January through May. To assess potential water temperature-related impacts of the Proposed Project/Action and alternatives on steelhead, the following parameters are evaluated: (1) long-term average water temperatures; (2) average water temperatures by water year type; (3) the cumulative probability distribution of water temperatures; and (4) the one-to-one relationship of water temperatures at Smartville, Daguerre Point Dam and Marysville.

Green Sturgeon

To assess potential flow-related impacts of the Proposed Project/Action and alternatives on green sturgeon, the following parameters are evaluated at Marysville: (1) long-term average flows; (2) average flow by water year type; (3) the cumulative probability distribution of flows; and (4) the one-to-one flow relationship (i.e., flows that would occur under the Proposed Project/Action and alternatives and the bases of comparison during the same year). Comparisons are conducted for each of the following life stages and life stage periodicities:

- Adult immigration and holding (February through July);
- Adult spawning and embryo incubation (March through July);
- Juvenile rearing (Year-round); and
- Juvenile emigration (May through September).

Potential water temperature-related impacts on green sturgeon are evaluated through assessments which focus on the life stages and the respective life stage periodicities described above for the following parameters: (1) long-term average water temperatures; (2) average water temperatures by water year type; (3) the cumulative probability distribution of water temperatures; and (4) the one-to-one relationship of water temperatures.

American Shad

Because the primary American shad adult immigration and spawning period in the lower Yuba River is believed to occur during April through June, potential changes in river flows during these months are evaluated for impact assessment. Potential flow-related impacts on American shad are assessed by determining the frequency and magnitude with which long-term average proportionate flows, and average proportionate flows by water year type, would change under the Proposed Project/Action and alternatives, relative to the bases of comparison, during the adult immigration and spawning period of April through June. Proportionate flows are represented by the ratio of the flow at Marysville to the flow at Shanghai Bench in the lower Feather River.

To evaluate potential water temperature-related impacts on American shad adult immigration and spawning, water temperatures simulated for the Proposed Project/Action and alternatives in the lower Yuba River at Marysville are compared to those simulated for the bases of comparison from April through June. Specifically, the frequency in which monthly mean April, May and June water temperatures at this location would be within the reported preferred range for American shad spawning (60°F to 70°F) is determined under the Proposed Project/Action and alternatives and compared to that under the bases of comparison.

Striped Bass

Potential flow-related impacts on striped bass are assessed by determining the frequency and magnitude with which long-term average proportionate flows, and average proportionate flows by water year type, would change under the Proposed Project/Action and alternatives, relative to the bases of comparison, during the adult spawning, embryo incubation and initial rearing period of April through June. Proportionate flows are represented by the ratio of the flow at Marysville to the flow at Shanghai Bench in the lower Feather River.

Optimal water temperatures for striped bass adult spawning, embryo incubation, and initial rearing are reported to range from approximately 59°F to 68°F (Moyle 2002). Therefore, to evaluate potential water temperature-related impacts on striped bass in the lower Yuba River, the frequencies with which modeled water temperatures exceed the 68°F water temperature index value or fall below the 59°F water temperature index value are compared to the frequencies which these water temperature exceed 68°F or fall below 59°F under the bases of comparison.

Other Fish Species of Management Concern

Current state (CALFED 1999; CDFG 1991a; CDFG 1993; CDFG 1996) and federal (USFWS 1995a) fishery management plans identify the highest management and population-enhancement priority for anadromous salmonids (i.e., steelhead and Chinook salmon). It is recognized that fish species other than the fish species and runs discussed above fill important ecological niches and have intrinsic value including hardhead, river lamprey, Sacramento perch, and San Joaquin roach. The habitat needs of anadromous salmonids have been extensively studied in California and elsewhere and, therefore, are reasonably well understood relative to the habitat needs of these other fish species. These other fish species of management concern are generally able to tolerate a wider range of environmental conditions than those identified for anadromous salmonids. Thus, for impact assessment purposes, potential impacts to these other fish species of management concern are indirectly evaluated through the year-round analysis of Chinook salmon life stages because impacts that are less than significant to Chinook salmon also would be less than significant to these other (more tolerant) fish species. If potentially significant impacts are identified for Chinook salmon, then additional species-specific evaluations are conducted.

LOWER FEATHER RIVER

The lower Feather River is utilized by a number of special-status fish species, primarily as habitat during one or more of their life stages, but also as a migration corridor to upstream habitat in other river systems (e.g., the Yuba River). Changes in CVP/SWP operations under the Proposed Project/Action and alternatives could potentially alter seasonal Oroville Reservoir operations and, thus, alter Feather River flows and water temperatures, which could change the relative habitat availability for fish species that are present in the lower Feather River.

For these reasons, species-specific impact assessments are conducted for the following species:

- Spring-run Chinook Salmon
- Fall-run Chinook Salmon
- Steelhead
- Southern DPS of North American Green Sturgeon
- Striped Bass
- American Shad
- Sacramento Splittail
- Other fish species of management concern including Hardhead, River Lamprey, Sacramento Perch, and San Joaquin Roach

Potential flow-related impacts are evaluated in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River. Changes in water surface elevations in Oroville Reservoir could affect the water temperature of releases from Oroville Dam and, therefore, potential water-related impacts are evaluated in the Low Flow Channel below the Fish Barrier Dam, in addition to below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River. Species-specific flow and water temperature assessment methodologies for the lower Feather River fisheries analyses are discussed below.

Spring-run Chinook Salmon

To assess potential flow-related impacts of the Proposed Project/Action and alternatives on spring-run Chinook salmon, the following parameters are evaluated: (1) long-term average monthly flows; (2) average monthly flow by water year type; (3) the cumulative probability distribution of monthly flows; (4) the one-to-one relationship (i.e., flows that would occur under the Proposed Project/Action and alternatives and the bases of comparison during the same year) of monthly flows; and (5) relationships between spawning habitat availability and discharge. Comparisons are conducted for each of the following life stages, life stage periodicities, and modeled locations:

- Adult immigration and holding (March through October - Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River);
- Adult spawning (September through December - Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet);
- Embryo incubation (early life stage survival) – (September through February);
- Juvenile rearing (Year-round - Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet); and
- Smolt emigration (October through June - Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River).

Potential water temperature-related impacts on spring-run Chinook salmon are evaluated for the life stages and the respective life history periodicities described above. To assess potential water temperature-related impacts of the Proposed Project/Action and alternatives on spring-run Chinook salmon, the following parameters are evaluated in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River: (1) long-term average monthly water temperatures; (2) average monthly water temperatures by water year type; (3) the cumulative probability distribution of monthly water temperatures; and (4) the one-to-one relationship of monthly water temperatures.

Fall-run Chinook Salmon

The adult spawning and embryo incubation life stage periodicities of fall-run Chinook salmon in the Feather River are not distinguished from those of the spring-run; therefore these life stages will not be evaluated separately.

To assess potential flow-related impacts of the Proposed Project/Action and alternatives on fall-run Chinook salmon, the same parameters described above for spring-run Chinook salmon are evaluated for the following life stages, life stage periodicities, and locations:

- Adult immigration and holding (July through December - Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River); and
- Juvenile rearing and outmigration (November through June - Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River).

To assess potential water temperature-related impacts of the Proposed Project/Action and alternatives on fall-run Chinook salmon adult immigration and holding, adult spawning and embryo incubation, and juvenile rearing and smolt emigration, the methodologies previously described for the lower Feather River spring-run Chinook salmon are used to evaluate potential impacts on fall-run Chinook salmon, with the following modifications:

- Adult immigration and holding (July through December); and
- Juvenile rearing and outmigration (November through June).

Steelhead

To assess potential flow-related impacts of the Proposed Project/Action and alternatives on steelhead, the same parameters described above for spring-run Chinook salmon are evaluated for the following life stages, life stage periodicities, and locations:

- Adult immigration and holding (August through April - Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River);
- Adult spawning (December through April[14] - Low Flow Channel below the Fish Barrier Dam, and below the Thermalito Afterbay Outlet);
- Juvenile rearing (Year-round - Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River); and
- Smolt emigration (October through May - Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River).

[14] Although lower Feather River steelhead spawning primarily occurs from December through March (DWR 2003a; McEwan 2001), fitting lower Feather River steelhead redd survey data (DWR 2003a) to an asymmetric logistic curve suggests that a small amount of lower Feather River steelhead spawning may occur in April. Because temporal weighting coefficients derived from the asymmetric logistic curve can be applied to the spawning habitat availability analysis to account for differences in monthly spawning intensity, lower Feather River steelhead spawning habitat availability will be evaluated from December through April.

Potential water temperature-related impacts of the Proposed Project/Action and alternatives, relative to the bases of comparison on life stages of Feather River steelhead are evaluated in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River. The methodology previously described for the Sacramento River steelhead impact assessment is used to evaluate potential water temperature-related impacts on Feather River steelhead, with the following modifications:

- Adult immigration and holding (August through April);
- Adult spawning (December through March); and
- Embryo incubation (December through May).

Green Sturgeon

The green sturgeon life stage period is believed to be the same in the lower Feather River as in the lower Yuba River. Therefore, the methodologies previously described for the lower Yuba River green sturgeon impacts assessment are used to evaluate potential impacts on lower Feather River green sturgeon, except that potential flow-related impacts are assessed below the Thermalito Afterbay Outlet, at Shanghai Bench, and at the mouth of the lower Feather River. Monthly mean flow at Shanghai Bench is represented by modeled flows below the Thermalito Afterbay Outlet, plus the modeled Yuba River inflow. Potential water temperature-related impacts are evaluated below Thermalito Afterbay Outlet and at the mouth of the lower Feather River.

American Shad

Because the primary American shad adult immigration and spawning period in the lower Feather River is believed to occur during April through June, potential changes in river flows during these months are evaluated for impact assessment. Potential flow-related impacts on American shad are assessed by determining the frequency and magnitude with which long-term average proportionate flows, and average proportionate flows by water year type, would change under the Proposed Project/Action and alternatives, relative to the bases of comparison, during the adult immigration and spawning period of April through June. Proportionate flows are represented by the ratio of the flow at the Mouth of the Feather River to the flow in the Sacramento River immediately downstream of the lower Feather River confluence.

To evaluate potential water temperature-related impacts on American shad adult immigration and spawning, water temperatures simulated for the Proposed Project/Action and alternatives in the lower Feather River at the Mouth are compared to those simulated for the bases of comparison from April through June. Specifically, the frequency in which monthly mean April, May and June water temperatures at this location would be within the reported preferred range for American shad spawning (60°F to 70°F) is determined under the Proposed Project/Action and alternatives and compared to that under the bases of comparison.

Striped Bass

Potential flow-related impacts on striped bass are assessed by determining the frequency and magnitude with which long-term average proportionate flows, and average proportionate flows by water year type, would change under the Proposed Project/Action and alternatives, relative to the bases of comparison, during the adult spawning, embryo incubation and initial rearing period of April through June. Proportionate flows are represented by the ratio of the flow at the mouth of the Feather River to the flow in the Sacramento River immediately downstream of the lower Feather River confluence.

Optimal water temperatures for striped bass adult spawning, embryo incubation, and initial rearing are reported to range from approximately 59°F to 68°F (Moyle 2002). Therefore, to evaluate potential water temperature-related impacts on striped bass in the lower Feather River, the frequencies with which modeled water temperatures at the Mouth exceed the 68°F water temperature index value or fall below the 59°F water temperature index value are compared to the frequencies which these water temperature exceed 68°F or fall below 59°F under the bases of comparison.

Sacramento Splittail

The effects assessment for Sacramento splittail in the lower Feather River relies on the analytical approach described in DWR's FERC Relicensing Report SPF 3.2 Task 3B, *Assessment of Potential Project Effects on Splittail Habitat* (DWR 2004a). To analyze the effects on Sacramento splitttail spawning, embryo incubation and initial rearing in the Feather River, DWR (2004a) examined the availability of flooded habitat downstream of the Thermalito Diversion Dam during February through May. DWR (2004a) identified two vegetation associations that provide suitable Sacramento splittail spawning habitat - gravel/sandbar and mixed emergent vegetation. DWR surveyed the lower Feather River for these two vegetation associations, and used the survey data to develop an index of usable flooded area (UFA) as function of river stage. UFA was defined as the area that would be flooded with depth of 3 to 6 feet (0.91 to 1.83 m). Stage-discharge relationships and polynomial regressions were utilized to generate UFA as function of flow.

To analyze potential impacts to Sacramento splittail associated with the Proposed Project/Action and alternatives, the simulated flows for February through May at Shanghai Bench and the UFA-discharge relationship presented in DWR (2004a) were used to calculate corresponding UFA values through linear interpolation. To obtain annual values of UFA, the resulting February through May monthly UFA values were summed and scaled to the sum of the maximum UFA value, and finally expressed as percentage. These annual UFA values were used to calculate corresponding long-term averages and averages for each water year type over the 72-year simulation period, as well as to build UFA exceedance curves for each Proposed Project/Action and alternative.

Changes in Sacramento splittail spawning, embryo incubation, and initial rearing habitat availability (expressed as scaled UFA) in the lower Feather River with implementation of the Proposed Project/Action and alternatives, relative to the basis of comparison were examined in three separate ways to determine whether Sacramento splittail has been substantially affected:

- A 10 percent or greater change in UFA by long-term average;
- A 10 percent or greater change in average UFA by water year type; and
- A 10 percent or greater change in UFA over more than 10 percent of the cumulative UFA distribution.

Based on a literature review of thermal tolerance studies and field observations, DWR (2004) determined that water temperatures between 45°F and 75°F constituted the range of suitable splittail spawning water temperatures. Thus, for this EIR/EIS, water temperature index values of 45°F and 75°F were established as evaluation guidelines to indicate whether Sacramento splittail has been substantially affected. For the lower Feather River, these water temperature index values apply to the water temperatures simulated below the Thermalito Afterbay during February through May.

Other Fish Species of Management Concern

It is recognized that fish species other than the fish species and runs discussed above fill important ecological niches and have intrinsic value including hardhead, river lamprey, Sacramento perch, and San Joaquin roach. These other fish species of management concern are generally able to tolerate a wider range of environmental conditions than those identified for anadromous salmonids. Thus, for impact assessment purposes, potential impacts to these other fish species of management concern are indirectly evaluated through the year-round analysis of Chinook salmon life stages because impacts that are less than significant to Chinook salmon also would be less than significant to these other (more tolerant) fish species. If potentially significant impacts are identified for Chinook salmon, then additional species-specific evaluations are conducted.

SACRAMENTO RIVER

The Sacramento River below the confluence with the Feather River is utilized by a number of fish species of management concern, either as habitat during one or more of their life stages or as a migration corridor to habitat in the upper Sacramento River, or tributaries to the Sacramento River. Changes in CVP/SWP operations under the Proposed Project/Action and alternatives could potentially alter seasonal flows and water temperatures in the Sacramento River, which in turn could affect the relative habitat availability for fish species that are present in the Sacramento River. For these reasons, species-specific impact assessments are conducted for the following species:

- Winter-run Chinook Salmon
- Fall-run Chinook Salmon
- Steelhead
- Striped Bass
- Sacramento Splittail
- Spring-run Chinook Salmon
- Late fall-run Chinook Salmon
- North American Green Sturgeon
- American Shad
- Other fish species of management concern including Hardhead, River Lamprey, Sacramento Perch, and San Joaquin Roach

Winter-run Chinook Salmon

To assess potential flow-related impacts of the Proposed Project/Action and alternatives on winter-run Chinook salmon, the following parameters are evaluated immediately downstream of the lower Feather River confluence (RM 80) and at Freeport (RM 46): (1) long-term average monthly flows; (2) average monthly flow by water year type; (3) the cumulative probability distribution of monthly flows; and (4) the one-to-one relationship (i.e., flows that would occur under the Proposed Project/Action and alternatives, and the bases of comparison during the same year) of monthly flows. Comparisons are conducted for the following life stages and life history periodicities:

- Adult immigration and holding (December through July); and
- Juvenile rearing and outmigration (June through April).

The NMFS BO for winter-run Chinook salmon and the NMFS OCAP BO provide flow criteria for the Sacramento River below Keswick Dam (NMFS 1995). NMFS requires that Reclamation maintain a minimum release from Keswick Dam of 3,250 cfs from October 1 through March 31.

As such, this minimum is included in the Sacramento River hydrologic modeling to prohibit the occurrence of simulated Keswick Dam releases less than 3,250 cfs. No specific flow requirements have been identified for other fish species in the upper Sacramento River, or for fish in the lower Sacramento River. Therefore, potential flow-related impacts determinations for fish species in the lower Sacramento River are based on an evaluation of the frequency and magnitude of change in modeled monthly mean flow, relative to the bases of comparison. A decrease in monthly flow of 10 percent or greater has been previously identified by various environmental documents as an appropriate criterion to evaluate flow changes.

Potential water temperature-related impacts on winter-run Chinook salmon are evaluated for the life stages and the respective life history periodicities described above. To assess potential water temperature-related impacts of the Proposed Project/Action and alternatives on winter-run Chinook salmon, the following parameters are evaluated immediately downstream of the lower Feather River confluence and at Freeport: (1) long-term average monthly water temperatures; (2) average monthly water temperatures by water year type; (3) the cumulative probability distribution of monthly water temperatures; and (4) the one-to-one relationship of monthly water temperatures.

Spring-run Chinook Salmon

To assess potential impacts on spring-run Chinook salmon adult immigration and holding, juvenile rearing, and smolt emigration, the methodologies previously described for Sacramento River winter-run Chinook salmon are used with the following modifications:

- Adult immigration and holding (February through September);
- Juvenile rearing (year-round); and
- Smolt emigration (October through June).

Fall-/Late Fall-run Chinook Salmon

Although fall- and late fall-run Chinook salmon are considered part of the same ESU, their life stages are evaluated separately because distinct differences in timing exist.

To assess potential impacts of the Proposed Project/Action and alternatives on fall-/late fall-run Chinook salmon adult immigration and holding and juvenile rearing and outmigration, the methodologies previously described for the Sacramento River winter-run Chinook salmon impact assessment are used to evaluate potential impacts on fall-run Chinook salmon, with the following modifications:

- Adult immigration and holding (July through December) for fall-run Chinook salmon and (October through April) for late fall-run Chinook salmon; and
- Juvenile rearing and outmigration (December through June) for fall-run Chinook salmon and (April through December) for late fall-run Chinook salmon.

Steelhead

To assess potential impacts on steelhead, the methodologies previously described for Sacramento River winter-run Chinook salmon are used with the following modifications:

- Adult immigration and holding (August through March);
- Juvenile rearing (year-round); and
- Smolt emigration (October through May).

Green Sturgeon

The green sturgeon life stage period is believed to be the same in the Sacramento River as in the lower Yuba River. Therefore, the methodologies previously described for the lower Yuba River green sturgeon impacts assessment are used to evaluate potential impacts on Sacramento River green sturgeon, except that potential flow-related impacts are assessed at immediately downstream of the lower Feather River confluence (RM 80) and at Freeport (RM 46); potential water temperature-related impacts are assessed immediately downstream of the Feather River confluence and at Freeport.

American Shad

Potential changes in river flows during the April through June American shad spawning migration period are evaluated for impact assessment purposes. To assess flow-related impacts resulting from implementation of the Proposed Project/Action and alternatives on American shad adult immigration and spawning, long-term average flows, average flows by water year type, the cumulative distribution of flows, and the one-to-one relationship of flows simulated for the Proposed Project/Action and alternatives immediately downstream of the lower Feather River confluence and at Freeport are compared to those simulated for the bases of comparison.

To evaluate potential water temperature-related impacts on American shad adult immigration and spawning, water temperatures simulated for the Proposed Project/Action and alternatives in the Sacramento River immediately downstream of the lower Feather River confluence and at Freeport are compared to those simulated for the bases of comparison from April through June. Specifically, the frequency in which monthly mean April, May and June water temperatures at these locations would be within the reported preferred range for American shad spawning (60°F to 70°F) is determined under the Proposed Project/Action and alternatives and compared to that under the bases of comparison.

Striped Bass

Potential changes in river flows during the April through June striped bass spawning and initial rearing period are evaluated for impact assessment purposes. To assess flow-related impacts resulting from implementation of the Proposed Project/Action and alternatives on striped bass spawning and initial rearing, long-term average flows, average flows by water year type, the cumulative distribution of flows, and the one-to-one relationship of flows simulated for the Proposed Project/Action and alternatives immediately downstream of the lower Feather River confluence and at Freeport are compared to those simulated for the bases of comparison.

To evaluate potential water temperature-related impacts on striped bass spawning and initial rearing, water temperatures simulated for the Proposed Project/Action and alternatives in the Sacramento River immediately downstream of the lower Feather River confluence and at Freeport are compared to those simulated for the bases of comparison from April through June. Specifically, the frequency in which monthly mean April, May and June water temperatures at these locations would be within the reported preferred range for striped bass spawning and initial rearing (60°F to 70°F) is determined under the Proposed Project/Action and alternatives and compared to that under the bases of comparison.

Sacramento Splittail

Sacramento splittail utilize the Sacramento River primarily as a migratory corridor to inundated flood plains such as the Yolo Bypass for spawning, egg incubation, and initial rearing. The persistence of the Sacramento splittail population is dependent on the frequency and duration of floodplain inundation during spring. To evaluate the effects on Sacramento splittail spawning, egg incubation and initial rearing in the Feather River, DWR (2004a) examined the availability of flood plain habitat during February through May. This time period also was applied to evaluate potential effects on splittail in the Sacramento River. The Sacramento River inundates the Yolo Bypass via the Freemont Weir when flows at Verona are greater than 56,000 cfs (JSA 2001). To evaluate potential flow-related impacts on splittail in the Sacramento River, the frequency with which the simulated monthly mean flows immediately downstream of the lower Feather River confluence during February through May exceed 56,000 cfs are compared between the Proposed Project/Action and alternatives, and the bases of comparison.

Based on field observations and a review of splittail thermal tolerance literature, DWR (2004a) concluded that water temperatures between 45°F and 75°F are suitable for splittail spawning. To evaluate potential water temperature-related impacts to splittail spawning, egg incubation, and initial rearing in the Sacramento River, the frequency for which simulated water temperatures immediately downstream of the lower Feather River confluence are outside of the 45°F to 75°F range are compared between the Proposed Project/Action and alternatives and the bases of comparison.

Other Fish Species of Management Concern

It is recognized that fish species other than the fish species and runs discussed above fill important ecological niches and have intrinsic value including hardhead, river lamprey, Sacramento perch, and San Joaquin roach. These other fish species of management concern are generally able to tolerate a wider range of environmental conditions than those identified for anadromous salmonids. Thus, for impact assessment purposes, potential impacts to these other fish species of management concern are indirectly evaluated through the year-round analysis of Chinook salmon life stages because impacts that are less than significant to Chinook salmon also would be less than significant to these other (more tolerant) fish species. If potentially significant impacts are identified for Chinook salmon, then additional species-specific evaluations are conducted.

10.2.2 Impact Indicators and Significance Criteria for Fisheries and Aquatic Resources

Impact indicators and evaluation guidelines have been developed as a means to assess potential operational-related effects of the Proposed Project/Action and alternatives on aquatic resources. For the fisheries and aquatic resources impact assessment, indicators (e.g., water temperatures, flows) are used to evaluate whether the project will have an impact on a species' habitat. Changes in river flows and water temperatures during certain periods of the year have the potential to affect all life stages of anadromous fish species. Therefore, changes in monthly mean river flows and water temperatures during the adult upstream migration and holding, spawning and embryo incubation, juvenile rearing and smolt emigration life stages of anadromous species are used as impact indicators.

Water temperature evaluation guidelines have been developed more extensively for Chinook salmon and steelhead than for other species because Chinook salmon and steelhead are native to the Pacific Coast and historically have been socially, recreationally, commercially, and economically important to the region. Because of this importance and because wild population levels of both species are currently low relative to historic levels (Moyle 2002), substantial effort may be expended examining the environmental requirements of Chinook salmon and steelhead in order to make informed management decisions. For Chinook salmon and steelhead, water temperature evaluation criteria have been developed in greater detail, relative to criteria developed to evaluate flow conditions, because:

- Among all environmental parameters, water temperature is suggested to have the greatest influence on the status of fish and aquatic life (McCullough *et al.* 2001; Myrick and Cech 2001);
- Coldwater species such as Chinook salmon and steelhead that are near the southernmost edge of their geographic distributional range (i.e., the California Central Valley) may be particularly constrained by elevated water temperatures, especially during the summer months when instream conditions tend to exhibit increased warming due to ambient solar radiation; and
- Life stage-specific thermal requirements for each salmonid species are consistent throughout the species' distributional range (McCullough *et al.* 2001), relative to life stage-specific flow requirements, which are stream-specific, depending on stream size and morphology. Thus, life stage-specific water temperature criteria can be developed to evaluate a fish species across multiple systems, while stream flow criteria developed for one watershed cannot necessarily be used to evaluate fish species across other watersheds.

The impact indicators and evaluation guidelines have been developed based on an extensive review of fisheries literature, with special emphasis on research conducted in the Central Valley. Although there may be small local variations in the time periods associated with stream-specific habitat utilization by different species and life stages, the temporal applications of timing periods used for analytical purposes in this document are based on studies in the Central Valley and are applied uniformly throughout the document. The specified time periods encompass the majority of activity for a particular life stage, and are not intended to be inclusive of every individual in the population.

Steelhead may rear in freshwater for one to two years before undergoing smoltification. Some individuals may rear in their natal streams, while others may volitionally or non-volitionally move downstream to enter the mainstem rivers, where they continue to rear until reaching a size at which smoltification is initiated, as observed by many YOY steelhead captured in RSTs in the Yuba, Feather and lower American rivers. The small sizes of juvenile steelhead captured at the RSTs support the presumption that these juvenile fish have not yet undergone smoltification, but instead are moving out of the river into downstream rearing habitat. Therefore, habitat conditions for YOY downstream moving juveniles are assessed using the juvenile rearing water temperature index values, whereas separate water temperature index values are used for the smolt emigration life stage.

As a comparative tool, life stage-specific water temperature impact indicator values to be used as evaluation guidelines have been developed, the bases of which are described in Appendix E2. The water temperature index values are not meant to be significance thresholds, but instead provide a mechanism by which to compare the Proposed Project/Action and alternatives to bases of comparison. Thus, water temperature index values represent a gradation of potential effects, from reported optimal water temperatures increasing through the range of represented index values for each life stage.

The presentation of index value crossings in the impact assessments is based on monthly mean water temperature modeling data. Index value crossings occur when the monthly mean water temperature under one scenario measurably differs from the monthly mean water temperature under the other scenario, and this difference results in the crossing of a designated index value for a particular species and life stage. The numbers of index value crossings reported in the impact assessments are the number of additional occurrences of monthly mean water temperatures, by location, that are higher or lower than a designated index value over the entire life stage under the Proposed Project/Action and alternatives, relative to the bases of comparison.

Differences in the frequency of exceeding a particular water temperature index value between the Proposed Project/Action or an alternative and the basis of comparison does not necessarily constitute an impact. Impact determinations are based on consideration of all evaluated impact indicators for all life stages for a particular species. An impact is considered potentially significant if implementation of the Proposed Project/Action or an alternative would adversely affect an individual species/run, for its defined geographic area (e.g., upper Feather River, lower Yuba River, etc.), in consideration of all evaluated impact indicators for all life stages. Specific impact indicators are presented in **Table 10-5**.

Table 10-5. Impact Indicators for the Quantitative Evaluation of Potential Operations-related Effects on Fish Species and Aquatic Habitats in the Study Area

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
New Bullards Bar, Oroville, and San Luis Reservoirs			
Warmwater Fish			
Spawning Success	March through June	Water surface elevations	A decrease in reservoir water surface elevation of six feet or more per month, relative to the basis of comparison, of sufficient frequency to substantially affect warmwater fish during the extended nesting season over the 72-year simulation period.
Coldwater Fish			
Coldwater Habitat Residence	April through November	Reservoir storage	A decrease in reservoir storage over the 72-year simulation period which would reduce the coldwater pool, relative to the basis of comparison, of sufficient magnitude or duration to adversely affect coldwater fish.
Lower Yuba River			
Spring-run Chinook Salmon in the Lower Yuba River			
Adult Immigration and Holding	March through October	Monthly mean flow (cfs) at Smartville and Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration	March through October	Monthly mean flow (cfs) at Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) decreases in monthly mean flows below 80 cfs; and (2) increases in monthly mean flows above 10,000 cfs.
Adult Immigration and Holding	March through October	Monthly mean stage at Smartville.	Change in monthly mean stage, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean stage equal to or greater than 1.0 foot

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Adult Immigration and Holding	March through October	Monthly mean water temperature (°F) at Smartville, Daguerre Point Dam, and at Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 64°F, and 68°F are used as evaluation guidelines to determine whether the species may be affected.
Adult Spawning	September through November[3]	Spawning habitat availability expressed as weighted usable area as a function of monthly mean flow from the terminus of the Narrows (RM 21.5) to Daguerre Point Dam (RM 11.4).	Change in spawning habitat availability (expressed as WUA), relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. (1) A 10 percent or greater change in WUA for greater than 10 percent of the cumulative WUA distribution is used to determine whether the species may be affected.
Adult Spawning	September through November[3]	Monthly mean water temperature (°F) at Smartville and Daguerre Point Dam.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 56°F, 58°F, 60°F, and 62°F are used as evaluation guidelines to determine whether the species may be affected.
Embryo Incubation	September through March	Monthly mean water temperature (°F) at Smartville and Daguerre Point Dam.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 56°F, 58°F, 60°F, and 62°F are used as evaluation guidelines to determine whether the species may be affected.
Juvenile Rearing[4]	Year-round	Monthly mean flow (cfs) at Smartville and Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Juvenile Rearing[4]	Year-round	Monthly mean water temperature (°F) at Smartville, Daguerre Point Dam, and Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 63°F, 65°F, 68°F, 70°F, and 75°F are used as evaluation guidelines to determine whether the species may be affected.
Smolt Emigration	November through June	Monthly mean flow (cfs) at Smartville and Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Smolt Emigration	November through June	Monthly mean water temperature (°F) at Smartville, Daguerre Point Dam, and Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 63°F, 68°F, and 70°F are used as evaluation guidelines to determine whether the species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Fall-run Chinook Salmon in the Lower Yuba River			
Adult Immigration and Holding	August through November	Monthly mean flow (cfs) at Smartville and Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration	August through November	Monthly mean flow (cfs) at Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) decreases in monthly mean flows below 80 cfs; and (2) increases in monthly mean flows above 10,000 cfs.
Adult Immigration and Holding	August through November	Monthly mean water temperature (°F) at Smartville, Daguerre Point Dam, and Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 64°F, and 68°F are used as evaluation guidelines to determine whether the species may be affected.
Adult Spawning	October through December[5]	Spawning habitat availability expressed as weighted usable area as a function of monthly mean flow from the terminus of the Narrows (RM 21.5) to lower Feather River Confluence (RM 0).	Change in spawning habitat availability (expressed as WUA), relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. (1) A 10 percent or greater change in WUA for greater than 10 percent of the cumulative WUA distribution is used to determine whether the species may be affected.
Adult Spawning	October through December[5]	Monthly mean water temperature (°F) at Smartville, Daguerre Point Dam, and at Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 56°F, 58°F, 60°F, and 62°F are used as evaluation guidelines to determine whether the species may be affected.
Embryo Incubation	October through March	Monthly mean water temperature (°F) at Smartville and Daguerre Point Dam.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 56°F, 58°F, 60°F, and 62°F are used as evaluation guidelines to determine whether the species may be affected.
Juvenile Rearing and Outmigration	December through June	Monthly mean flow (cfs) at Smartville and Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Juvenile Rearing and Outmigration	December through June	Monthly mean water temperature (°F) at Smartville, Daguerre Point Dam, and Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 63°F, 65°F, 68°F, 70°F, and 75°F are used as evaluation guidelines to determine whether the species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Steelhead in the Lower Yuba River			
Adult Immigration and Holding	August through March	Monthly mean flow (cfs) at Smartville and Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration	August through March	Monthly mean flow (cfs) at Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) decreases in monthly mean flows below 80 cfs; and (2) increases in monthly mean flows above 10,000 cfs.
Adult Immigration and Holding	August through March	Monthly mean water temperature (°F) at Smartville, Daguerre Point Dam, and Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 52°F, 56°F, and 70°F are used as evaluation guidelines to determine whether this species may be affected.
Adult Spawning	January through April	Spawning habitat availability expressed as weighted usable area as a function of monthly mean flow from the terminus of the Narrows (RM 21.5) to Daguerre Point Dam (RM 11.4).	Change in spawning habitat availability (expressed as WUA), relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. A 10 percent or greater change in WUA for greater than 10 percent of the cumulative WUA distribution is used to determine whether the species may be affected.
Adult Spawning	January through April	Monthly mean water temperature (°F) at Smartville and Daguerre Point Dam.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 52°F, 54°F, 57°F, and 60°F are used as evaluation guidelines to determine whether this species may be affected.
Embryo Incubation	January through May	Monthly mean water temperature (°F) at Smartville and Daguerre Point Dam.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 52°F, 54°F, 57°F, and 60°F are used as evaluation guidelines to determine whether this species may be affected.
Juvenile Rearing[6]	Year-round	Monthly mean flow (cfs) at Smartville and Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Juvenile Rearing[6]	Year-round	Monthly mean water temperature (°F) at Smartville, Daguerre Point Dam, and Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 65°F, 68°F, 72°F, and 75°F are used as evaluation guidelines to determine whether this species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Smolt emigration	October through May	Monthly mean flow (cfs) at Smartville and Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Smolt emigration	October through May	Monthly mean water temperature (°F) at Smartville, Daguerre Point Dam, and Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period June over the 72-year simulation period. Water temperature index values[1,2] of 52°F 55°F, and 59°F are used as evaluation guidelines to determine whether this species may be affected.
Green Sturgeon in the Lower Yuba River			
Adult Immigration and Holding	February through July	Monthly mean flow (cfs) at Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration and Holding	February through July	Monthly mean water temperature (°F) at Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 61°F is used as evaluation guideline to determine whether this species may be affected.
Adult Spawning	March through July	Monthly mean flow (cfs) at Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Spawning	March through July	Monthly mean water temperature (°F) at Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 68°F is used as evaluation guideline to determine whether this species may be affected.
Embryo Incubation	March through July	Monthly mean flow (cfs) at Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Embryo Incubation	March through July	Monthly mean water temperature (°F) at Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[[2,7]] of 68°F is used as evaluation guideline to determine whether this species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Juvenile Rearing	Year-round	Monthly mean flow (cfs) at Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Juvenile Rearing	Year-round	Monthly mean water temperature (°F) at Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 66°F is used as evaluation guideline to determine whether this species may be affected.
Juvenile emigration	May through September	Monthly mean flow (cfs) at Marysville.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Juvenile emigration	May through September	Monthly mean water temperature (°F) at Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 66°F is used as evaluation guideline to determine whether this species may be affected.
American Shad in the Lower Yuba River			
Adult Immigration and Spawning	April through June	Monthly mean flow (cfs) at Marysville, relative to monthly mean flow (cfs) in the lower Feather River at Shanghai Bench.	Change in long-term average proportionate flows, or average proportionate flows by water year type, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period.
Adult Immigration and Spawning	April through June	Monthly mean water temperature (°F) at Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[2,7] of 60°F and 70°F are used as evaluation guidelines to determine whether this species may be affected.
Striped Bass in the Lower Yuba River			
Adult Spawning, Embryo Incubation, and Initial Rearing	April through June	Monthly mean flow (cfs) at Marysville, relative to monthly mean flow (cfs) in the lower Feather River at Shanghai Bench.	Change in long-term average proportionate flows, or average proportionate flows by water year type, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period.
Adult Spawning, Embryo Incubation, and Initial Rearing	April through June	Monthly mean water temperature (°F) at Marysville.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[2,7] of 59°F and 68°F are used as evaluation guidelines to determine whether this species may be affected.
Lower Feather River			
Spring-run Chinook Salmon in the Lower Feather River			
Adult Immigration and Holding	March through October	Monthly mean flow (cfs) in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Adult Immigration and Holding	March through October	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 64°F, and 68°F are used as evaluation guidelines to determine whether this species may be affected.
Adult Spawning[8]	September through December	Spawning habitat availability expressed as weighted usable area as a function of monthly mean flow from the Fish Barrier Dam (RM 67) downstream to Honcut Creek (RM 44).	Change in spawning habitat availability (expressed as WUA), relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. (1) A 10 percent or greater change in WUA for greater than 10 percent of the cumulative WUA distribution is used to determine whether this species may be affected.
Adult Spawning	September through December	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month over the 72-year simulation period. Water temperature index values[1,2] of 56°F, 58°F, 60°F, and 62°F are used as evaluation guidelines to determine whether this species may be affected.
Pre-spawned Eggs, Fertilized Embryos, and Pre-emergent Fry [9]	September through February	Annual early life stage survival, from pre-spawned eggs through fry emergence is based on Reclamation's Salmon Mortality Model output.	Change in annual or long-term average early life stage survival, relative to the basis of comparison, of sufficient magnitude to substantially affect initial year-class strength over the 71-year simulation period.
Embryo Incubation	September through February	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month over the 72-year simulation period. Water temperature index values[1,2] of 56°F, 58°F, 60°F, and 62°F are used as evaluation guidelines to determine whether this species may be affected.
Juvenile Rearing[4]	Year-round	Monthly mean flow (cfs) in the Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Juvenile Rearing[4]	Year-round	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 63°F, 65°F, 68°F, 70°F, and 75°F are used as evaluation guidelines to determine whether this species may be affected.
Smolt Emigration	October through June	Monthly mean flow (cfs) in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Smolt Emigration	October through June	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 63°F, 68°F, and 70°F are used as evaluation guidelines to determine whether this species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Fall-run Chinook Salmon in the Lower Feather River			
Adult Immigration and Holding	July through December	Monthly mean flow (cfs) in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration and Holding	July through December	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 64°F, and 68°F are used as evaluation guidelines to determine whether this species may be affected.
Adult Spawning[8]	September through December	Spawning habitat availability expressed as weighted usable area as a function of monthly mean flow from the Fish Barrier Dam (RM 67) downstream to Honcut Creek (RM 44).	Change in spawning habitat availability (expressed as WUA), relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. (1) A 10 percent or greater change in WUA for greater than 10 percent of the cumulative WUA distribution is used to determine whether this species may be affected.
Adult Spawning	September through December	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month over the 72-year simulation period. Water temperature index values[1,2] of 56°F, 58°F, 60°F, and 62°F are used as evaluation guidelines to determine whether this species may be affected.
Pre-spawned Eggs, Fertilized Embryos, and Pre-emergent Fry[9]	September through February	Annual early life stage survival, from pre-spawned eggs through fry emergence is based on Reclamation's Salmon Mortality Model output.	Change in annual or long-term average early life stage survival, relative to the basis of comparison, of sufficient magnitude to substantially affect initial year-class strength over the 71-year simulation period.
Embryo Incubation	September through February	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month over the 72-year simulation period. Water temperature index values[1,2] of 56°F, 58°F, 60°F, and 62°F are used as evaluation guidelines to determine whether this species may be affected.
Juvenile Rearing and Outmigration	November through June	Monthly mean flow (cfs) in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Juvenile Rearing and Outmigration	November through June	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 63°F, 65°F, 68°F, 70°F, and 75°F are used as evaluation guidelines to determine whether this species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Steelhead in the Lower Feather River			
Adult Immigration and Holding	August through April	Monthly mean flow (cfs) in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration and Holding	August through April	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 52°F, 56°F, and 70°F are used as evaluation guidelines to determine whether this species may be affected.
Adult Spawning	December through April[10]	Spawning habitat availability expressed as weighted usable area as a function of monthly mean flow from the Fish Barrier Dam (RM 67) downstream to Honcut Creek (RM 44).	Change in spawning habitat availability (expressed as WUA), relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. (1) A 10 percent or greater change in WUA for greater than 10 percent of the cumulative WUA distribution is used to determine whether this species may be affected.
Adult Spawning	December through March[10]	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 52°F, 54°F, 57°F, and 60°F are used as evaluation guidelines to determine whether this species may be affected.
Embryo Incubation	December through May	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 52°F, 54°F, 57°F, and 60°F are used as evaluation guidelines to determine whether this species may be affected.
Juvenile Rearing[6]	Year-round	Monthly mean flow (cfs) in the Low Flow Channel below the Fish Barrier Dam and below the Thermalito Afterbay Outlet.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Juvenile Rearing[6]	Year-round	Monthly mean water temperature (°F) in the Low Flow Channel below the Fish Barrier Dam and below Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 65°F, 68°F, 72°F, and 75°F are used as evaluation guidelines to determine this species may be affected.
Smolt emigration	October through May	Monthly mean flow (cfs) below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Smolt emigration	October through May	Monthly mean water temperature (°F) below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period June over the 72-year simulation period. Water temperature index values[1,2] of 52°F 55°F, and 59°F are used as evaluation guidelines to determine whether this species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Green Sturgeon in the Lower Feather River			
Adult Immigration and Holding	February through July	Monthly mean flows (cfs) below the Thermalito Afterbay Outlet, at Shanghai Bench, and at the mouth of the lower Feather River. Monthly mean flows at Shanghai Bench are represented by modeled flows below the Thermalito Afterbay Outlet, plus the modeled Yuba River inflows.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) Changes in monthly mean flows equal to or greater than 10 percent; and (2) Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration and Holding	February through July	Monthly mean water temperature (°F) below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 61°F is used as evaluation guideline to determine whether this species may be affected.
Adult Spawning	March through July	Monthly mean flow (cfs) below the Thermalito Afterbay Outlet.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Spawning	March through July	Monthly mean water temperature (°F) below the Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 68°F is used as evaluation guideline to determine whether this species may be affected.
Embryo Incubation	March through July	Monthly mean flow (cfs) below the Thermalito Afterbay Outlet.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Embryo Incubation	March through July	Monthly mean water temperature (°F) below the Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 68°F is used as evaluation guideline to determine whether this species may be affected.
Juvenile Rearing	Year-round	Monthly mean flow (cfs) below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Juvenile Rearing	Year-round	Monthly mean water temperature (°F) below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 66°F is used as evaluation guideline to determine whether this species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Juvenile Emigration	May through September	Monthly mean flow (cfs) below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Juvenile Emigration	May through September	Monthly mean water temperature (°F) below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 66°F is used as evaluation guideline to determine whether this species may be affected.
American Shad in the Lower Feather River			
Adult Immigration and Spawning	April through June	Monthly mean flows (cfs) at the mouth of the lower Feather River, relative to monthly mean flows (cfs) in the Sacramento River immediately downstream of the lower Feather River confluence.	Change in long-term average proportionate flows, or proportionate flows by water year type, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period.
Adult Immigration and Spawning	April through June	Monthly mean water temperatures (°F) at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[2,7] of 60°F and 70°F are used as evaluation guidelines to determine whether this species may be affected.
Striped Bass in the Lower Feather River			
Adult Spawning, Embryo Incubation, and Initial Rearing	April through June	Monthly mean flows (cfs) at the mouth of the lower Feather River, relative to monthly mean flows (cfs) in the Sacramento River immediately downstream of the lower Feather River confluence.	Change in long-term average proportionate flows, or proportionate flows by water year type, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period.
Adult Spawning, Embryo Incubation, and Initial Rearing	April through June	Monthly mean water temperatures (°F) at the mouth of the lower Feather River.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[2,7] of 59°F and 68°F are used as evaluation guidelines to determine whether this species may be affected.
Sacramento Splittail in the Lower Feather River			
Adult Spawning, Embryo Incubation, and Initial Rearing	February through May	Availability of flooded habitat expressed as usable flooded area as a function of monthly mean flows at Shanghai Bench.	Changes in the availability of flooded habitat (expressed as UFA), relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) a 10 percent or greater change in UFA by long-term average; (2) a 10 percent or greater change in average UFA by water year type; and (3) a 10 percent or greater change in UFA over more than 10 percent of the cumulative UFA distribution.
Adult Spawning, Embryo Incubation, and Initial Rearing	February through May	Monthly mean water temperature (°F) below the Thermalito Afterbay Outlet.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[2,7] of 45°F and 75°F are used as evaluation guidelines to determine whether this species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Sacramento River			
Winter-run Chinook Salmon in the Sacramento River			
Adult Immigration and Holding	December through July	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species has been substantially affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration and Holding	December through July	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 64°F, and 68°F are used as evaluation guidelines to determine whether this species may be affected.
Juvenile Rearing and Outmigration	June through April	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Juvenile Rearing and Outmigration	June through April	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 63°F, 65°F, 68°F, 70°F, and 75°F are used as evaluation guidelines to determine whether this species may be affected.
Spring-run Chinook Salmon in the Sacramento River			
Adult Immigration and Holding	February through September	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species has been substantially affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration and Holding	February through September	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 64°F, and 68°F are used as evaluation guidelines to determine whether this species may be affected.
Juvenile Rearing[4]	Year-round	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Juvenile Rearing[4]	Year-round	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 63°F, 65°F, 68°F, 70°F, and 75°F are used as evaluation guidelines to determine whether this species may be affected.
Smolt Emigration	October through June	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence, and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Smolt Emigration	October through June	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 63°F, 68°F, and 70°F are used as evaluation guidelines to determine whether this species may be affected.
Fall-/Late Fall-run Chinook Salmon in the Sacramento River			
Adult Immigration and Holding	Fall-run: July through December Late fall-run: October through April	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species has been substantially affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration and Holding	Fall-run: July through December Late Fall-run: October through April	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 64°F, and 68°F are used as evaluation guidelines to determine whether this species may be affected.
Juvenile Rearing and Outmigration	Fall-run: December through June Late Fall-run: April through December	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Juvenile Rearing and Outmigration	Fall-run: December through June Late Fall-run: April through December	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 60°F, 63°F, 65°F, 68°F, 70°F, and 75°F are used as evaluation guidelines to determine whether this species may be affected.
Steelhead in the Sacramento River			
Adult Immigration and Holding	August through March	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species has been substantially affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration and Holding	August through March	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 52°F, 56°F, and 70°F are used as evaluation guidelines to determine whether this species may be affected.
Juvenile Rearing[6]	Year-round	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Juvenile Rearing[6]	Year-round	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 65°F, 68°F, 72°F, and 75°F are used as evaluation guidelines to determine whether this species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Smolt Emigration	October through May	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Smolt Emigration	October through May	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[1,2] of 52°F 55°F, and 59°F are used as evaluation guidelines to determine whether this species may be affected.
Green Sturgeon in the Sacramento River			
Adult Immigration and Holding	February through July	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration and Holding	February through July	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 61°F is used as evaluation guideline to determine whether this species may be affected.
Adult Spawning	March through July	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Spawning	March through July	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 68°F is used as evaluation guideline to determine whether this species may be affected.
Embryo Incubation	March through July	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Embryo Incubation	March through July	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 68°F is used as evaluation guideline to determine whether this species may be affected.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Juvenile Rearing	Year-round	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution) are used as evaluation criteria to determine whether this species may be affected.
Juvenile Rearing	Year-round	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 66°F is used as evaluation guideline to determine whether this species may be affected.
Juvenile Emigration	May through September	Monthly mean flow (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Juvenile Emigration	May through September	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. A water temperature index value[2,7] of 66°F is used as evaluation guideline to determine whether this species may be affected.
American Shad in the Sacramento River			
Adult Immigration and Spawning	April through June	Monthly mean flows (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Immigration and Spawning	April through June	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[2,7] of 60°F and 70°F are used as evaluation guidelines to determine whether this species may be affected.
Striped Bass in the Sacramento River			
Adult Spawning, Embryo Incubation, and Initial Rearing	April through June	Monthly mean flows (cfs) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean flow, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species for any given month of the evaluation period over the 72-year simulation period. Evaluation criteria used to determine whether this species may be affected include: (1) changes in monthly mean flows equal to or greater than 10 percent; and (2) changes in flows equal to or greater than 10 percent during low flow conditions (i.e., when flows are in approximately the lowest 25 percent of the cumulative flow distribution).
Adult Spawning, Embryo Incubation, and Initial Rearing	April through June	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence and at Freeport.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[2,7] of 59°F and 68°F are used as evaluation guidelines to determine whether this species may be affected.
Sacramento Splittail in the Sacramento River			
Adult Spawning, Embryo Incubation, and Initial Rearing	February through May	Monthly mean flows (cfs) immediately downstream of the lower Feather River confluence.	Change in the frequency with which monthly mean flows exceed 56,000 cfs, relative to the basis of comparison, to substantially affect this species for any given month of the evaluation period over the 72-year simulation period.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
Adult Spawning, Embryo Incubation, and Initial Rearing	February through May	Monthly mean water temperature (°F) immediately downstream of the lower Feather River confluence.	Change in monthly mean water temperature, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect this species, for any given month of the evaluation period over the 72-year simulation period. Water temperature index values[2,7] of 45°F and 75°F are used as evaluation guidelines to determine whether this species may be affected.
Sacramento-San Joaquin Delta			
Delta smelt spawning	February through July	Monthly mean location of X2	Change in upstream movement of the monthly mean location of X2, relative to the basis of comparison, of sufficient magnitude and frequency to result in an upstream shift in X2 location of 1.0 km or more and, thus result in a substantial level of habitat modification or degradation which would affect the physical habitat availability or habitat constituent element suitability for delta smelt, for any given month of the year over the 72-years simulated. Changes in monthly mean location of X2 by 1.0 km or more are used as evaluation guidelines to determine whether impacts to delta smelt and its habitat potentially could occur.
Delta smelt spawning	February through July	Monthly mean location of X2	The number of occurrences, relative to the basis of comparison, in which X2 shifts upstream past any of the three compliance points (i.e., Roe Island, Chipps Island, and the Confluence) of sufficient frequency to result in a substantial level of habitat modification or degradation which would affect the physical habitat availability or habitat constituent element suitability for delta smelt, for any given month of the year over the 72-years simulated. The number of occurrences of X2 shifts upstream past a compliance point is used as an evaluation guideline to determine whether impacts to delta smelt and its habitat potentially could occur.
Delta smelt spawning	February through June	Movement of X2 between Suisun Bay and the Confluence of the Sacramento-San Joaquin rivers	Change in monthly mean location of X2, relative to the basis of comparison, that is of sufficient magnitude and frequency to result in an upstream shift in the location of X2 that simultaneously meets the following conditions: (1) upstream shift(s) in X2 location are 0.5 km or more; and (2) upstream shift(s) in X2 location of 0.5 km or more that occur when X2 is already located between Chipps Island [RKm 74] and the Confluence [RKm 81] and, thus, result in a substantial level of habitat modification or degradation which would affect the physical habitat availability or habitat constituent element suitability for delta smelt, for any given month of the year over the 72-years simulated. Changes in monthly mean location of X2 that are 0.5 km or more are used as evaluation guidelines to determine whether impacts to delta smelt and its habitat potentially could occur.
Delta smelt spawning	February through July	Monthly mean Delta Outflow (cfs).	Change in monthly mean Delta outflow, relative to the basis of comparison, of sufficient magnitude and frequency to result in a substantial level of habitat modification or degradation which would affect the physical habitat availability or habitat constituent element suitability for delta smelt, for any given month of the year over the 72-years simulated. Monthly mean Delta outflows under the basis of comparison are used as evaluation guidelines to determine whether impacts to delta smelt and its habitat potentially could occur.
Delta smelt spawning	February through July	Export-to-Inflow Ratio.	Change in monthly mean Delta Export-to-Inflow Ratio, relative to the basis of comparison, of sufficient magnitude and frequency to result in a substantial level of habitat modification or degradation which would affect the physical habitat availability or habitat constituent element suitability for delta smelt, for any given month of the evaluation period over the 72-years simulated. Monthly mean Delta Export-to-Inflow Ratios under the basis of comparison are used as evaluation guidelines to determine whether impacts to habitat for delta smelt potentially could occur.
NA – (All relevant life stages of all Delta species except delta smelt are addressed here)	Year-round	Monthly mean location of X2	Changes in upstream movement of the monthly mean location of X2, relative to the basis of comparison, of sufficient magnitude (i.e., 1.0 km or more) and frequency past a Delta compliance point (i.e., the Confluence [RM 81], Chipps Island [RM 74] or Roe Island [RM 64] to result in habitat modification or degradation which would affect the physical habitat availability or habitat constituent element suitability for Delta fisheries resources, for any given month of the year over the 72-year simulation period.

Life Stage	Evaluation Period	Impact Indicator	Indicator Value
			Changes in monthly mean location of X2 by 1.0 km or more are used as evaluation guidelines to determine whether impacts potentially could occur.
NA – (All relevant life stages of all Delta species except delta smelt are addressed here)	Year-round	Monthly mean Delta Outflows (cfs)	Changes in monthly mean Delta outflows, relative to the basis of comparison, of sufficient magnitude and frequency to result in habitat modification or degradation which would affect the physical habitat availability or habitat constituent element suitability for Delta fisheries resources, for any given month of the year over the 72-year simulation period. Monthly mean Delta outflows under the basis of comparison are used as evaluation guidelines to determine whether impacts to habitat for Delta fisheries resources potentially could occur.
NA – (All relevant life stages of all delta species except delta smelt are addressed here)	Year-round	Export-to-Inflow Ratio	Changes in monthly mean Delta Export-to-Inflow Ratio, relative to the basis of comparison, of sufficient magnitude and frequency to result in habitat modification or degradation which would affect the physical habitat availability or habitat constituent element suitability for Delta fisheries resources, for any given month of the evaluation period over the 72-year simulation period. Monthly mean Delta Export-to-Inflow Ratios under the basis of comparison are used as evaluation guidelines to determine whether substantial impacts to habitat for Delta fisheries resources potentially could occur.
NA	Adults: December through March Juveniles: April through May	Change in CVP/SWP salvage estimates for delta smelt.	Change in the annual median salvage, or monthly median salvage by water year type at the CVP and SWP fish facilities, relative to the basis of comparison, over the 11-year period of record (1993-2003).
NA	Year-round	Change in CVP/SWP salvage estimates for winter-run and spring-run Chinook salmon, steelhead, and striped bass.	Change in the monthly mean salvage by water year type at the CVP and SWP fish facilities, relative to the basis of comparison, over the 11-year period of record (1993-2003).

Notes:

[1] See Appendix E2 for water temperature index value selection rationale and supporting literature.

[2] Water temperature index values are not meant to be significance thresholds, but instead provide a mechanism by which to compare the Proposed Project/Action and alternatives to the basis of comparison.

[3] Spring-run Chinook salmon spawning in the Yuba River reportedly occurs from September through November (CDFG 1991a). However, for analytical purposes, September was assumed to represent the period of spring-run Chinook salmon spawning that is distinct from fall-run Chinook salmon spawning, although considerable temporal and spatial overlap in spawning occurs between these two runs. Therefore, the month of September is emphasized in the spring-run Chinook salmon spawning WUA evaluation.

[4] It is recognized that some spring-run Chinook salmon emigrate from natal streams soon after emergence (NMFS 2004). Because the spring-run Chinook salmon juvenile rearing life stage is evaluated year-round and the juvenile rearing effect indicator values are identical to those for emigrating YOY spring-run Chinook salmon, the evaluation of the effects of the proposed project on emigrating YOY spring-run Chinook salmon during winter-months is contained within the winter months evaluation for the juvenile rearing life stage.

[5] The primary lower Yuba River fall-run Chinook salmon spawning period reportedly occurs from October through December (CALFED and YCWA 2005). However, fitting lower Yuba River fall-run Chinook salmon carcass survey data (YCWA 1992; YCWA 1994; YCWA 1996; YCWA 1997; YCWA 1998; YCWA 1999; YCWA 2000a; YCWA 2001; YCWA 2002; YCWA 2003; YCWA 2006a; YCWA 2006b) to an asymmetric logistic curve suggests that a small amount of fall-run Chinook salmon spawning may occur in January (See Appendix E1). The month of January was included in the spawning habitat availability evaluation because temporal (i.e., monthly) weighting coefficients derived from the asymmetric logistic curve were applied in this specific evaluation, thereby appropriately accounting for the minimal amount of fall-run Chinook salmon spawning during January.

[6] It is recognized that some YOY steelhead emigrate from natal streams during most months of the year (NMFS 2004). Because the steelhead juvenile rearing life stage is evaluated year-round and the juvenile rearing effect indicator values are identical to those for emigrating YOY steelhead, the evaluation of the effects of the proposed project on emigrating YOY steelhead are evaluated within the juvenile rearing life stage.

[7] See Section 10-1, Environmental Setting/Affected Environment for index value selection rationale and supporting literature.

[8] Because no clear distinction between spring- and fall-run Chinook salmon spawning can be derived from lower Feather River Chinook salmon carcass survey data, the WUA analysis used to analyze potential impacts on the two runs is combined into one expanded spawning season that is inclusive of all Chinook salmon spawning in the Feather River.

[9] Because no clear distinction between spring-run and fall-run Chinook salmon spawning can be derived from lower Feather River Chinook salmon carcass survey data, the lower Feather River Salmon Mortality Model analysis is assumed to represent the analysis for both runs.

[10] The primary lower Feather River steelhead spawning period occurs from December through March. However, fitting lower Feather River steelhead redd survey data (DWR 2003a) to an asymmetric logistic curve suggests that a small amount of lower Feather River steelhead spawning may occur in April. The month of April was included in the spawning habitat availability evaluation because temporal (i.e., monthly) weighting coefficients derived from the asymmetric logistic curve were applied in this specific evaluation, thereby appropriately accounting for the minimal amount of steelhead spawning during April.

NA – not applicable.

As discussed in Chapter 4, CEQA and NEPA have different legal and regulatory standards that require slightly different assumptions in the modeling runs used to compare the Proposed Project/Action and alternatives to the appropriate CEQA and NEPA bases of comparison in the impact assessments. Although only one project (the Yuba Accord Alternative) and one action alternative (the Modified Flow Alternative) are evaluated in this EIR/EIS, it is necessary to use separate NEPA and CEQA modeling scenarios for the Proposed Project/Action, alternatives and bases of comparisons to make the appropriate comparisons. As a result, the scenarios compared in the impact assessments below have either a "CEQA" or a "NEPA" prefix before the name of the alternative being evaluated. A detailed discussion of the different assumptions used for the CEQA and NEPA scenarios is included in Appendix D, Modeling Technical Memorandum.

As also discussed in Chapter 4, while the CEQA and NEPA analyses in this EIR/EIS refer to "potentially significant," "less than significant," "no" and "beneficial" impacts, the first two comparisons (CEQA Yuba Accord Alternative compared to the CEQA No Project Alternative and CEQA Modified Flow Alternative compared to the CEQA No Project Alternative) presented below instead refer to whether or not the proposed change would "unreasonably affect" the evaluated parameter. This is because these first two comparisons are made to determine whether the action alternative would satisfy the requirement of Water Code Section 1736 that the proposed change associated with the action alternative "would not unreasonably affect fish, wildlife, or other instream beneficial uses."

10.2.3 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE CEQA YUBA ACCORD ALTERNATIVE COMPARED TO THE CEQA NO PROJECT ALTERNATIVE

Pursuant to Water Code §1736, the SWRCB is authorized to approve long-term changes in YCWA's permits, allowing the transfer or exchange of water, if the proposed changes:

- Would not result in substantial injury to any legal user of water; and
- Would not unreasonably affect fish, wildlife, or other instream beneficial uses.

This comparison of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, provides an evaluation of the potential effects on fish in the Project Area.

10.2.3.1 YUBA REGION

NEW BULLARDS BAR RESERVOIR

Impact 10.2.3-1: Decreases in New Bullards Bar Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June, with the majority of warmwater fish spawning occurring during the months of April and May. Decreases in the water surface elevation of New Bullards Bar Reservoir by more than 6 feet per month from March through June would occur approximately 7 times less often under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 75 through 86). Reduction in the frequency of potential nest dewatering events would be expected to result in increased nest success and contribute to self-sustaining warmwater fish populations. Therefore, impacts upon warmwater fisheries that may be present in New Bullards Bar Reservoir from potential changes in water surface elevation under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative may be beneficial.

Impact 10.2.3-2: Decreases in New Bullards Bar Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

The CEQA Yuba Accord Alternative would result in a long-term average New Bullards Bar Reservoir storage of approximately 809 TAF during April to 551 TAF during November (Appendix F4, 3 vs. 2, pg. 1). This reduction would correspond to a change in water surface elevation from approximately 1,920 feet msl to 1,851 feet msl. Under the CEQA No Project Alternative, the November long-term average storage in New Bullards Bar Reservoir would be approximately 600 TAF with a corresponding elevation of 1,865 feet msl (Appendix F4, 3 vs. 2, pg. 50).

Anticipated reductions in reservoir storage associated with the CEQA Yuba Accord Alternative would not be expected to adversely impact the New Bullards Bar Reservoir's coldwater fisheries because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample coldwater pool reserves. Throughout the period of operations of New Bullards Bar Reservoir (1969 through present), which encompasses the most extreme critically dry year on record, the coldwater pool in New Bullards Bar Reservoir has not been depleted. In fact, since 1993, coldwater pool availability in New Bullards Bar Reservoir has been sufficient to accommodate year-round utilization of the lower outlets from the dam to the New Colgate tunnel, at the direction provided by CDFG, to provide the coldest water possible to the lower Yuba River. Therefore, potential reductions in coldwater pool storage would not be expected to adversely affect New Bullards Bar Reservoir's coldwater fisheries because: (1) coldwater habitat would remain available in the reservoir during all months of the CEQA Yuba Accord Alternative; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fish. In conclusion, the CEQA Yuba Accord Alternative would not unreasonably affect New Bullards Bar Reservoir coldwater fisheries resources, and would provide an equivalent or higher level of protection, relative to the CEQA No Project Alternative.

LOWER YUBA RIVER

As described in the Modeling Technical Appendix (Appendix D), different dispatch, reservoir, and operating rules govern the proposed project and the basis of comparison. In addition to different minimum flow release requirements, the proposed project and the basis of comparison utilize different water availability indices, and have different reservoir dispatch rules based on those different flow schedules and indices.

Because the outlet capacity of the Narrows I and Narrows II powerhouses that release flow to the lower Yuba River totals 4,170 cfs, flows above that level are "uncontrolled" (spilling over the top of Englebright Dam). Differences in flows between the proposed project and the basis of comparison above that level therefore tend to be a function of river and reservoir operations in response to storm and flood control requirements.

In wetter year classes, annual Yuba River operations are primarily driven by flood control requirements. In the winter months of wetter year classes, maintenance of appropriate flood pool space may require releases well in excess of required minimums. During the summer months of wetter year classes, releases in excess of required minimum flows and delivery obligations are often required to draw down the reservoir to an appropriate level going into the succeeding fall and winter season. In drier water year types, under both the proposed project and the basis of comparison, storm and flood operations cease to be a major influence in operations decisions early in the season, and the Yuba Project is operated to meet minimum flow requirements and consumptive demands.

The following sections describe and discuss flow and water temperature differences between the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, and potential effects on fisheries and aquatic resources in the lower Yuba River.

Impact 10.2.3-3: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The adult immigration and holding life stage primarily extends from March through October. Evaluation of flows at Marysville occurring under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative indicate that both alternatives would provide adequate flows for adult spring-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam (Appendix F4, 3 vs. 2, pg. 272). Also, under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, flows in the lower Yuba River throughout the upstream migration period generally would remain within the range sufficient to allow adequate passage of adult spring-run Chinook salmon through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville would result in the same number of occurrences (4 out of 576 months included in the analysis) during which flows at the Daguerre Point Dam fish ladders would exceed 10,000 cfs under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative (Appendix F4 3 vs. 2, pgs. 273 through 284). Finally, under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, stages at Smartville throughout the adult holding period would remain similar. Overall, examination of monthly mean stage simulated at Smartville would result in 1 decrease of one foot or more (out of 576 months included in the analysis) under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 162 through 173). These relatively infrequent and minor changes in stage would not affect adult spring-run Chinook salmon holding habitat conditions, particularly due to the deep nature of the pools in the Narrows Reach below Englebright Dam.

During the March through October adult immigration and holding life stage, water temperatures at Smartville, under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, generally would remain at or below 58°F, which is below the lowest water temperature index value (60°F) for this life stage (Appendix F4, 3 vs. 2, pg. 174).

Simulated water temperatures at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative generally would not exceed 60°F over the entire cumulative water temperature distributions from March through August, and during October. However, during September under the CEQA Yuba Accord Alternative, water temperatures would remain below 60°F with about a 90 percent probability, by contrast to about a 60 percent probability under the CEQA No Project Alternative. Overall, during the entire March through October adult immigration and holding period at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 22 decreases below the 60°F index value, no changes at the 64°F index value, and 2 increases above the 68°F index value (Appendix G, 3 vs. 2, pgs. G-2 through G-4).

In addition, while the presence of spring-run Chinook salmon below Daguerre Point Dam during the immigration and holding life stage is believed to be transitory, the cumulative water temperature distribution under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would illustrate generally equivalent water temperatures as far downstream as Marysville during March and April, measurably warmer water temperatures frequently occurring during relatively warm water temperature conditions during May and June, and frequent and substantially lower water temperatures from July through October. Specifically, during the warmest months of July and August, water temperatures under the CEQA Yuba Accord Alternative would be substantially lower (generally about 1 – 3°F) and therefore more suitable, over nearly the entire cumulative water temperature distributions. Overall, during the March through October adult immigration and holding life stage at Marysville, the CEQA Yuba Accord Alternative would result in 64 decreases below the 60°F index value, 48 decreases below the 64°F index value, and 2 increases above the 68°F index value, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 371 through 382).

Spring-run Chinook salmon spawning reportedly occurs above Daguerre Point Dam from September through November. During these months, the annual spawning habitat availability under the CEQA Yuba Accord Alternative would be similar to that under the CEQA No Project Alternative (long-term average of 89.2 percent versus 89.1 percent of the maximum WUA) (Appendix F4, 3 vs. 2, pg. 395). The CEQA Yuba Accord Alternative would achieve over 90 percent of maximum WUA with a 72 percent probability, while the CEQA No Project Alternative would achieve over 90 percent of maximum WUA with a 67 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 3 vs. 2, pg. 399).

The spring-run Chinook salmon spawning habitat analysis also emphasized the month of September, because this is the only month during the spring-run Chinook salmon spawning period that is assumed to not temporally overlap with fall-run Chinook salmon spawning (CDFG 2000). For September, spawning habitat availability, expressed as percent maximum WUA, under the CEQA Yuba Accord Alternative would be similar to that under the CEQA No Project Alternative (long-term average of 90.1 percent versus 90.3 percent of maximum WUA) (Appendix F4, 3 vs. 2, pg. 395). Overall, for the month of September, both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would achieve over 90 percent of maximum WUA with about a 62 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 3 vs. 2, pg. 397).

Water temperatures at Smartville during the September through November spawning period would not exceed 56°F, and therefore would remain suitable for this life stage (Appendix F4, 3 vs. 2, pgs. 175 through 186). Simulated water temperatures at Daguerre Point Dam during November would not exceed 56°F (Appendix F4, 3 vs. 2, pgs. 224 through 235). During September, simulated water temperatures at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would exceed 56°F over the entire cumulative water temperature distributions. Under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, water temperatures would be essentially equivalent over approximately 55 percent, and would be measurably lower over approximately 40 percent of the cumulative water temperature distributions during September. During relatively warm water temperature conditions, water temperatures under the CEQA Yuba Accord Alternative would be lower, and therefore more suitable, than under the CEQA No Project Alternative with about a 90 percent probability during September. During October, simulated water temperatures at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would exceed 56°F with slightly more than a 90 percent probability. However, during October, simulated water temperatures at Daguerre Point Dam under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would be essentially equivalent over approximately 50 percent, and would be measurably lower over approximately 50 percent of the cumulative water distribution. During relatively warm water temperature conditions, water temperatures under the CEQA Yuba Accord Alternative would be lower, and therefore more suitable, than under the CEQA No Project Alternative with about a 75 percent probability during October (Appendix F4, 3 vs. 2, pgs. 248 through 259). Overall, during the entire September through November spawning period, at Daguerre Point Dam the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 58°F index value, 21 decreases below the 60°F index value, and 3 decreases below the 62°F index value (Appendix G, 3 vs. 2, pgs. G-2 through G4).

The embryo incubation life stage for spring-run Chinook salmon in the lower Yuba River generally occurs between September and March. Timing of fry emergence is primarily dependant on water temperature. As illustrated above for the spawning life stage, water temperatures at Daguerre Point Dam under the CEQA Yuba Accord Alternative would be generally cooler, and therefore more suitable for embryo incubation, than under the CEQA No Project Alternative during the September through November period. Between December and March, water temperatures would not exceed 53°F, and therefore remain suitable for embryo incubation at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 248 through 259).

Spring-run Chinook salmon juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to spring-run Chinook salmon juveniles.

Simulated water temperature conditions at Daguerre Point Dam, and as far downstream as Marysville would generally be substantially lower, and therefore more suitable, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative during the over-summer rearing period. At Daguerre Point Dam and Marysville during the warmest months of July and August, water temperatures under the CEQA Yuba Accord Alternative would be substantially lower (generally about 0.5 – 3°F) and therefore more suitable, over nearly the entire cumulative water temperature distributions (Appendix F4, 3 vs. 2, pgs. 248 through 259 and 371 through 382).

Overall, during the year-round juvenile rearing life stage at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 22 decreases below the 60°F index value, no changes at the 63°F index value, 1 increase above the 65°F index value, 2 increases above the 68°F index value, and no changes at the 70°F or 75°F index values. Overall, at Marysville, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 64 decreases below the 60°F index value, 46 decreases below the 63°F index value, 31 decreases below the 65°F index value, 2 increases above the 68°F index value, 2 increases above the 70°F index value, and 1 increase above the 75°F index value (Appendix G, 3 vs. 2, pgs. G-2 through G-4).

The spring-run Chinook salmon smolt emigration period is believed to extend from November through June, although based on CDFG's run-specific determinations, the vast majority (about 94 percent) of spring-run Chinook salmon were captured as post-emergent fry during November and December, with a relatively small percentage (nearly 6 percent) of individuals remaining in the lower Yuba River and captured as YOY from January through March. Only 0.6 percent of the juvenile Chinook salmon identified as spring-run was captured during April, 0.1 percent during May, and none were captured during June. In general, flows during the early portion (November through January) of the smolt emigration period under the CEQA Yuba Accord Alternative would be measurably lower at intermediate to high flow conditions, and would be measurably higher than flows under the CEQA No Project Alternative during relatively low flow to intermediate flow conditions. Flow reductions at the intermediate to high flow levels would not be expected to substantively affect spring-run Chinook salmon smolt emigration habitat conditions, whereas the measurably higher flows during low flow conditions may facilitate smolt emigration. During winter (February and March), flows under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would be generally similar. During relatively low to intermediate flow conditions, which generally occur during the drier water year types, the CEQA Yuba Accord Alternative would result in substantively higher flows during early spring (April) and lower flows during later spring (May and June) (Appendix F4, 3 vs. 2, pgs. 125 through 136 and 297 through 308). This pattern during drier years would occur due to an intentional operational shift in spring peak flows from late-spring to early-spring (e.g., late-May to April). The temporal shift in drier year flows was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes. This flow pattern was designed to facilitate the emigration of juvenile spring-run Chinook salmon before warm water temperatures occur during late spring in drier water years in the lower portion of the lower Yuba River, the Feather River, and the Sacramento River as illustrated in **Table 10-6.**

Table 10-6. Average Water Temperature by Water Year Type in the Yuba, Feather, and Sacramento Rivers

Month	River	Water Year Type[1] (Water Temperature °F)				
		Wet	Above Normal	Below Normal	Dry	Critical
April	Yuba[2]	54.1	53.9	53.6	53.2	52.8
	Feather[3]	58.9	61.1	61.1	61.7	62.8
	Sacramento[4]	58.6	60.6	61.2	61.7	62.6
May	Yuba	54.3	55.9	56.9	58.4	60.1
	Feather	63.4	65.9	66.3	67.5	68.5
	Sacramento	64.1	66.4	66.6	67.1	68.0
June	Yuba	56.1	58.8	60.3	62.4	64.9
	Feather	67.1	70.3	70.3	72.5	72.8
	Sacramento	68.2	70.7	70.5	71.8	71.0

1 – Based on Sacramento Valley 40-30-30 Index
2 – Lower Yuba River at Marysville
3 – Feather River at the Mouth
4 – Sacramento River below the Feather River Confluence

During the November through June smolt emigration life stage, water temperatures at Smartville under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would remain below 60°F, and therefore remain suitable for this life stage (Appendix F4, 3 vs. 2, pgs. 175 through 186 and 199 through 210).

Simulated water temperatures at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would remain below 60°F, and therefore would remain suitable, over the entire cumulative water temperature distributions from November through April, and would remain below 60°F with about a 99 and 96 percent probability during May and June, respectively (Appendix F4, 3 vs. 2, pgs. 248 through 259). Overall, during the entire November through June smolt emigration period at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 60°F index value, 1 increase above the 63°F index value, and no changes at the 68°F and 70°F index values (Appendix G, 3 vs. 2, pgs. G-2 through G-4).

Simulated water temperature conditions at Marysville during the spring-run Chinook salmon smolt emigration period would remain below the lowest water temperature index value of 60°F, and therefore would remain suitable, from November through April under the CEQA Yuba Accord Alternative. Water temperatures would remain at or below 60°F with about a 90 percent probability during May, and with about a 55 percent probability during June under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 371 through 382). Overall at Marysville, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, would result in 8 decreases below the 60°F index value, 13 increases above the 63°F index value (which occur during June), and no increases or decreases at higher index values (Appendix G, 3 vs. 2, pgs. G-2 through G-4).

During May and June, warmer water temperature conditions generally correspond to drier water year types. As described above, under the CEQA Yuba Accord Alternative the temporal shift in spring peak flows from late-spring to early-spring (e.g., late-May to April) was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes, to facilitate the emigration of juvenile spring-run Chinook salmon before warm water temperatures occur in the lower portion of the lower Yuba River, the Feather River, and the Sacramento River. Therefore, the measurable increases in water temperatures, during relatively warm water temperature conditions, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative during June would not be expected to substantively affect smolt emigration.

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) similar holding habitat conditions above Daguerre Point Dam; and (4) frequently cooler and therefore more suitable water temperatures at Daguerre Point Dam during September

- Improved spawning conditions due to similar spawning habitat availability during the entire September through November adult spawning period, as well as during September separately as a temporally distinct month, and generally lower and therefore more suitable water temperatures, particularly during about the warmest 45 to 55 percent of simulated water temperature conditions at Daguerre Point Dam during September and October

- Improved embryo incubation conditions due to frequently and substantially lower, and therefore more suitable water temperatures, particularly during about the warmest 45 to 55 percent of simulated water temperature conditions during September and October at Daguerre Point Dam

- Improved over-summer juvenile rearing conditions, due to consistently and substantially lower (generally about 0.5 – 3°F), and therefore more suitable, water temperatures at Daguerre Point Dam and at Marysville
- Generally equivalent smolt emigration conditions during the majority of the smolt emigration period (November through March), with lower flows during approximately the lowest 40 percent of flow conditions in May and June, accompanied by higher flows during about the lowest 35 percent of flow conditions during April. Under the Yuba Accord Alternative, this temporal shift in drier year flows was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes. This flow pattern was designed to facilitate the emigration of juvenile Chinook salmon when most of them are emigrating, and before warm water temperatures occur during late spring in drier water years in the lower portion of the lower Yuba River, the Feather River, and the Sacramento River.

In conclusion, in consideration of potential effects to all life stages of spring-run Chinook salmon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for spring-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-4: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The adult immigration and holding life stage for fall-run Chinook salmon in the lower Yuba River primarily extends from August through November. Evaluation of flows at Marysville occurring under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative indicate that both alternatives would provide adequate flows for adult fall-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam. Also, under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, flows in the lower Yuba River throughout the upstream migration period would remain within the range sufficient to allow adequate passage of adult fall-run Chinook salmon through the Daguerre Point Dam fish ladders. Simulated flows at both Smartville and Marysville would be higher by ten percent or more ranging from more than 40 percent probability to nearly 90 percent probability from August through November under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. During relatively low flow conditions from August through November, higher flows of ten percent or more would occur ranging from more than a 70 percent probability to a 96 percent probability (Appendix F4, 3 vs. 2, pgs. 125 through 136 and 297 through 308).

During the August through November adult immigration and holding life stage, water temperatures at Smartville, under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, generally would remain at or below 58°F, and therefore would remain suitable for this life stage (Appendix F4, 3 vs. 2, pgs. 175 through 186).

Simulated water temperatures at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative generally would not exceed 60°F, and therefore would remain suitable, over the entire cumulative water temperature distributions during August, October, and November. However, during September water temperatures would be more suitable under the CEQA Yuba Accord Alternative, remaining below 60°F with about a 90 percent probability, by contrast to about a 60 percent probability under the CEQA No Project Alternative. Overall, during the entire August through November adult immigration and holding period at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 22 decreases below the 60°F index value, no changes at the 64°F index value, and 1 increase above the 68°F index value (Appendix F4, 3 vs. 2, pgs. 248 through 259).

The cumulative water temperature distributions under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, indicate that generally equivalent or cooler, and therefore more suitable, water temperatures as far downstream as Marysville would occur during the adult immigration and holding period, particularly during August and September. Relative to the CEQA No Project Alternative, monthly mean water temperatures under the CEQA Yuba Accord Alternative would be measurably lower, and therefore more suitable with about an 85 and a 40 percent probability during August and September, respectively. During relatively warm water temperature conditions, water temperatures under the CEQA Yuba Accord Alternative at Marysville would be measurably lower, and therefore more suitable, than under the CEQA No Project Alternative with about a 90 percent probability during both August and September. Overall at Marysville, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, would result in 50 decreases below the 60°F index value, 36 decreases below the 64°F index value, and 2 increases above the 68°F index value (Appendix F4, 3 vs. 2, pgs. 371 through 382).

Fall-run Chinook salmon spawning occurs in the lower Yuba River from October through December, and may extend into January. During these months, the annual spawning habitat availability under the CEQA Yuba Accord Alternative would be slightly higher than under the CEQA No Project Alternative (long-term average of 87.5 percent versus 86.8 percent of the maximum WUA) (Appendix F4, 3 vs. 2, pg. 400). The CEQA Yuba Accord Alternative would achieve over 90 percent of maximum WUA with a 66 percent probability, while the CEQA No Project Alternative would achieve over 90 percent of maximum WUA with a 62 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 3 vs. 2, pg. 402).

Water temperatures at Smartville during the October through December period would not exceed 56°F, and therefore would remain suitable for this life stage (Appendix F4 3 vs. 2, pgs. 199 through 210). Simulated water temperatures at Daguerre Point Dam and Marysville during November and December would not exceed 56°F, and therefore would remain suitable for adult spawning. During October under relatively warm water temperature conditions, water temperatures under the CEQA Yuba Accord Alternative would be lower, and therefore more suitable than the CEQA No Project Alternative with about a 75 percent probability at Daguerre Point Dam, and with about an 80 percent probability at Marysville. Overall, the CEQA Yuba Accord Alternative would result in 1 decrease below the 62°F index value and no changes at other index values at Daguerre Point Dam, and no changes at the 56°F index value, 1 increase above the 58°F index value, 13 decreases below the 60°F index value, and 1 decrease below the 62°F index value at Marysville (Appendix F4, 3 vs. 2, pgs. 248 through 259 and 371 through 382).

The embryo incubation period for fall-run Chinook salmon extends from October through March. In addition to the trends described above, between January and March, water temperatures would not exceed 54°F, and therefore would remain suitable for embryo incubation at Daguerre Point Dam and Marysville under both the CEQA Yuba Accord

Alternative and the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 248 through 259 and 371 through 382).

Juvenile fall-run Chinook salmon rear in and emigrate from the lower Yuba River between December and June, although based on CDFG's run-specific determinations, the majority (about 81 percent) of fall-run Chinook salmon are captured moving downstream from December through March, with decreasing numbers captured during April (about 9 percent), May (about 7 percent), and June (about 3 percent). The discussion of flow and water temperature changes provided for spring-run Chinook salmon smolt emigration (see above) encompasses the entire fall-run Chinook salmon juvenile rearing and outmigration time period. The only differences are that the juvenile fall-run Chinook salmon rearing and outmigration period encompasses one less month (November), and includes slightly different water temperature index values (Appendix G, 3 vs. 2, pgs. G-6 through G-7).

Overall, during the entire December through June juvenile rearing and outmigration period at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 60°F index value, 1 increase above the 63°F index value, and no changes at the 65°F, 68°F and 70°F index values (Appendix F4, 3 vs. 2, pgs. 249 through 259). Overall at Marysville, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, would result in 8 decreases below the 60°F index value, 13 increases above the 63°F index value (which occur during June), 3 increases above the 65°F index value, and no increases or decreases at higher index values (Appendix F4, 3 vs. 2, pgs. 371 through 382 and Appendix G, 3 vs. 2, pgs. G-6 through G-7).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; and (3) frequently cooler and therefore more suitable water temperatures at Daguerre Point Dam during September, and consistently and substantially lower (generally about 1 – 3°F), and therefore more suitable, water temperatures from August through October at Marysville

- Improved spawning conditions due to similar spawning habitat availability during the entire October through December adult spawning period, and generally lower and therefore more suitable water temperatures, particularly during about the warmest 55 to 70 percent of simulated water temperature conditions at Daguerre Point Dam and at Marysville during October

- Improved embryo incubation conditions due to frequently and substantially lower (and therefore more suitable) water temperatures during about the warmest 55 to 70 percent of simulated water temperature conditions at Daguerre Point Dam and at Marysville during October

- Generally equivalent juvenile rearing and outmigration conditions during the majority of this life stage (December through March), with lower flows during approximately the lowest 40 percent of flow conditions in May and June, accompanied by higher flows during about the lowest 35 percent of flow conditions during April. Under the Yuba

Accord Alternative, a temporal shift in drier year flows was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes. This flow pattern was designed to facilitate the emigration of juvenile Chinook salmon when most of them are emigrating, and before warm water temperatures occur during late spring in drier water years in the lower portion of the lower Yuba River, the Feather River, and the Sacramento River.

In conclusion, in consideration of potential effects to all life stages of fall-run Chinook salmon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for fall-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-5: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for steelhead adult immigration and holding in the lower Yuba River extends from August through March. Evaluation of flows at Marysville occurring under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative indicate that both alternatives would provide adequate flows for adult steelhead upstream critical riffle passage below Daguerre Point Dam. Also, under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, flows in the lower Yuba River throughout the upstream migration period generally would remain within the range sufficient to allow adequate passage of adult steelhead through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville would result in 1 less occurrence during which flows at the Daguerre Point Dam fish ladders exceed 10,000 cfs under the CEQA Yuba Accord Alternative (13 out of 576 months included in the analysis), relative to the CEQA No Project Alternative (14 out of 576 months) (Appendix F4, 3 vs. 2, pgs. 273 through 284).

Simulated flows at both Smartville and Marysville would be higher by ten percent or more ranging from more than 40 to nearly 90 percent probability from August through November, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative. During relatively low flow conditions from August through November, higher flows of ten percent or more would occur from more than 70 to about 95 percent of the time. In general, flows during December and January of the adult immigration and holding period under the CEQA Yuba Accord Alternative would be measurably lower at intermediate to high flow conditions (generally above 850 and 950 cfs at Smartville and Marysville, respectively), and would be measurably higher than flows under the CEQA No Project Alternative during relatively low flow to intermediate flow conditions. Flow reductions at the intermediate to high flow levels would not be expected to substantively affect steelhead adult immigration and holding habitat conditions, whereas the measurably higher flows during low flow conditions may benefit adult steelhead immigration and holding conditions. During February and March, flows under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would be generally similar (Appendix F4, 3 vs. 2, pgs. 125 through 136 and 297 through 308).

Under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, water temperatures at Smartville would remain cool and generally less than 56°F from August through October, and generally less than 52°F from November through March (Appendix F4, 3 vs. 2, pgs. 199 through 210).

The cumulative water temperature distributions under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, indicate that generally equivalent or cooler water temperatures at Daguerre Point Dam and at Marysville would occur during the entire adult immigration and holding period, and substantially cooler water temperatures during August and September. During relatively warm water temperature conditions, water temperatures under the CEQA Yuba Accord Alternative would be frequently and consistently measurably lower, and therefore more suitable, than under the CEQA No Project Alternative during August through October at Daguerre Point Dam and at Marysville (Appendix F4, 3 vs. 2, pgs. 248 through 259 and 371 through 382).

During November, water temperatures at both Daguerre Point Dam and Marysville under the CEQA Yuba Accord Alternative would remain below about 55°F. During December through February, water temperatures at Daguerre Point Dam and Marysville would remain below 52°F, and therefore would remain suitable for adult immigration and holding. During March, water temperatures at Daguerre Point Dam and at Marysville under the CEQA Yuba Accord Alternative would be essentially equivalent to water temperatures under the CEQA No Project Alternative, and would not exceed 54°F (Appendix F4, 3 vs. 2, pgs. 248 through 259 and 371 through 382).

Overall, during the adult immigration and holding life stage at Smartville, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 2 increases above the 52°F index value, and no changes at other index values. At Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 2 increases above the 52°F index value, 9 decreases below the 56°F index value, and no changes at the 70°F index value. At Marysville, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 4 increases above the 52°F index value, and 1 decrease below the 56°F index value, and 2 increases above the 70°F index value (Appendix F4, 3 vs. 2, pgs. 248 through 259 and 371 through 382).

The steelhead spawning season generally extends from January through April, primarily occurring in reaches upstream of Daguerre Point Dam. During these months, the annual spawning habitat availability under the CEQA Yuba Accord Alternative would be slightly higher than under the CEQA No Project Alternative (long-term average of 36.9 percent versus 35.6 percent of the maximum WUA) (Appendix F4, 3 vs. 2, pg. 403). The CEQA Yuba Accord Alternative would achieve over 50 percent of maximum WUA with about a 35 percent probability, while the CEQA No Project Alternative would achieve over 50 percent of maximum WUA with about a 30 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 3 vs. 2, pg. 405).

From January through March, water temperatures at Smartville would not exceed 52°F, which is the lowest water temperature index value for this life stage, and therefore would remain suitable for adult spawning (Appendix F4, 3 vs. 2, pgs. 199 through 210). During January and February, water temperatures at Daguerre Point Dam also would not exceed 52°F. During March, water temperatures at Daguerre Point Dam under the CEQA Yuba Accord Alternative would be essentially equivalent to water temperatures under the CEQA No Project Alternative, and would exceed 52°F with about a 25 percent probability, yet would remain below 54°F (Appendix F4, 3 vs. 2, pgs. 248 through 259).

During April, water temperatures at Smartville and Daguerre Point Dam under the CEQA Yuba Accord Alternative would be essentially equivalent to the water temperatures under the CEQA No Project Alternative over nearly the entire cumulative water temperature distributions and would remain below about 56°F (Appendix F4, 3 vs. 2, pgs. 199 through 210 and 248 through 259).

Overall, during the adult spawning life stage, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 2 increases above the 52°F index value, and no changes at other index values at Smartville. At Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 52°F index value, and no changes at other index values (Appendix F4, 3 vs. 2, pgs. 199 through 210 and 248 through 259).

The embryo incubation period for steelhead in the lower Yuba River general overlaps with the spawning period, but extends into May. During May, water temperatures at Smartville under the CEQA Yuba Accord Alternative would be essentially equivalent to the water temperatures under the CEQA No Project Alternative over the entire cumulative water temperature distribution (Appendix F4, 3 vs. 2, pgs. 175 through 186).

During May, water temperatures at Daguerre Point Dam under the CEQA Yuba Accord Alternative would be essentially equivalent to the water temperatures under the CEQA No Project Alternative over approximately 65 percent of the cumulative water temperature distribution, and would be measurably higher with about a 35 percent probability. During May under relatively warm water temperature conditions, water temperatures under the CEQA Yuba Accord Alternative would be measurably higher than the CEQA No Project Alternative with more than a 65 percent probability at Daguerre Point Dam, yet generally would remain below about 57°F (Appendix F4, 3 vs. 2, pgs. 224 through 235).

Overall, during the embryo incubation life stage at Smartville, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 11 increases above the 52°F index value, and no changes at the 54°F, 57°F, or 60°F index values (Appendix F4, 3 vs. 2, pgs. 175 through 186). At Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 52°F index value, no changes at the 54°F index value, 1 increase above the 57°F index value, and no changes at the 60°F index value (Appendix F4, 3 vs. 2, pgs. 224 through 235).

Steelhead juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles.

Simulated water temperature conditions at Daguerre Point Dam, and as far downstream as Marysville would be generally anticipated to be substantially lower, and therefore more suitable, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative during the over-summer rearing period. At Daguerre Point Dam and Marysville during the warmest months of July and August, water temperatures under the CEQA Yuba Accord Alternative would be substantially lower (generally about 0.5 – 3°F) and therefore more suitable, over nearly the entire cumulative water temperature distributions (Appendix F4, 3 vs. 2, pgs. 248 through 259 and 371 through 382).

Overall, during the year-round juvenile rearing life stage at Smartville, no changes at any index value would be observed. At Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 65°F index value, 2 increases above the 68°F index value, and no change at the 72°F or 75°F index values (Appendix F4, 3 vs. 2, pgs. 224 through 235). Overall, at Marysville, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 31 decreases below the 65°F index value, 2 increases above the 68°F index value, no changes at the 72°F index value, and 1 increase above the 75°F index value (Appendix F4, 3 vs. 2, pgs. 347 through 358).

The steelhead smolt emigration period is believed to extend from October through May. Simulated flows at both Smartville and Marysville would be higher by ten percent or more ranging from more than 40 to nearly 70 percent probability during October and November, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative. During relatively low flow conditions during October and November, higher flows of ten percent or more would occur nearly 90 percent of the time. In general, flows during December and January of the smolt emigration period under the CEQA Yuba Accord Alternative would be measurably lower at intermediate to high flow conditions (generally above 850 and 950 cfs at Smartville and Marysville, respectively), and would be measurably higher than flows under the CEQA No Project Alternative during relatively low flow to intermediate flow conditions. Flow reductions at the intermediate to high flow levels would not be expected to substantively affect steelhead smolt emigration habitat conditions, whereas the measurably higher flows during low flow conditions may benefit smolt emigration conditions. During February and March, flows under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would be generally similar (Appendix F4, 3 vs. 2, pgs. 125 through 136 and 297 through 308).

During relatively low to intermediate flow conditions, which generally occur during to the drier water year types, the CEQA Yuba Accord Alternative would result in substantively higher flows during early spring (April) and lower flows during later spring (May). This pattern during drier years would occur due to an intentional operational shift in spring peak flows from late-spring to early-spring (e.g., late-May to April). The temporal shift in drier year flows was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes. This flow pattern was designed to facilitate steelhead smolt emigration before warm water temperatures occur during late spring in drier water years in the lower portion of the lower Yuba River, the Feather River, and the Sacramento River.

Water temperatures at Smartville during the October through May smolt emigration life stage would be cool, and generally would remain below 55°F during October, below 52°F November through April, and below 53°F during May under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative. Overall, during the entire October through May smolt emigration period at Smartville, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 13 increases above the 52°F index value, 1 increase above the 55°F index value, and no change at the 59°F index value (Appendix F4, 3 vs. 2, pgs. 199 through 210).

Simulated water temperatures at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would generally remain below 59°F over the entire cumulative water temperature distributions from October through May. Overall, during the entire October through May smolt emigration period at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 3 increases above the 52°F index value, 3 decreases below the 55°F index value, and no changes at the 59°F index value (Appendix F4, 3 vs. 2, pgs. 248 through 259).

At Marysville, under relatively warm water temperature conditions during October, water temperatures under the CEQA Yuba Accord Alternative would be lower, and therefore more suitable than under the CEQA No Project Alternative with about an 80 percent probability, and would be essentially equivalent with nearly a 20 percent probability. Simulated water temperatures under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would remain below the lowest water temperature index value of 52°F approximately 50 percent of the time, and below 55°F about 50 percent of the time during November. From December through February, water temperatures would remain below 52°F, which is the lowest water temperature index value for this life stage. During March and April, water temperatures generally would remain below 55°F. Water temperatures during May would remain at or below 55°F with about a 25 percent probability under both alternatives, and would remain at or below 59°F with about an 80 and 90 percent probability, under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, respectively (Appendix F4, 3 vs. 2, pgs. 371 through 382). Overall, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would result in 3 increases above the 52°F index value, 1 increase above the 55°F index value, and 35 decreases below the 59°F index value (Appendix F4, 3 vs. 2, pgs. 347 through 358).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) similar holding habitat conditions; and (4) consistently and substantially lower, and therefore more suitable, water temperatures during August, September, and October in the lower section of the river
- Generally equivalent or improved spawning conditions due to slightly higher spawning habitat availability, and generally equivalent water temperatures above Daguerre Point Dam during the January through April adult spawning period
- Equivalent water temperature conditions over the entire embryo incubation period at Smartville; generally equivalent conditions at Daguerre Point Dam over the majority of the embryo incubation period, with slightly higher water temperatures during May although water temperatures remain below 57°F
- Improved over-summer juvenile rearing conditions, due to consistently and substantially lower (generally about 0.5 – 3°F), and therefore more suitable, water temperatures at Daguerre Point Dam and at Marysville
- Generally equivalent smolt emigration conditions during the majority of this life stage (October through March), with lower flows during approximately the lowest 40 percent of flow conditions in May, accompanied by higher flows during about the lowest 35 percent of flow conditions during April. Under the Yuba Accord Alternative, a temporal shift in drier year flows was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes. This flow pattern was designed to facilitate the emigration of juvenile steelhead when most of them are emigrating, and before warm water temperatures occur during late spring in drier water years in the lower portion of the lower Yuba River, the Feather River, and the Sacramento River.

In conclusion, in consideration of potential effects to all life stages of steelhead, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for steelhead and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-6: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect green sturgeon

Flows during the green sturgeon immigration and holding (February through July) and adult spawning and embryo incubation (March through July) life stage periods would be expected to allow adequate upstream migration and spawning habitat availability, under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Overall, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, would result in 16 decreases below the 61°F index value for adult immigration and holding, and no changes at the 68°F index value for adult spawning and embryo incubation (Appendix F4, 3 vs. 2, pgs. 199 through 210 and 371 through 382).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juveniles.

Simulated water temperature conditions at Marysville would generally be anticipated to be substantially lower, and therefore more suitable, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative during the over-summer rearing period. At Marysville during the warmest months of July and August, water temperatures under the CEQA Yuba Accord Alternative would be substantially lower (generally about 1 – 3°F) and therefore potentially more suitable, over nearly the entire cumulative water temperature distributions. Overall, during the year-round juvenile green sturgeon rearing life stage, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 12 decreases below the 66°F index value (Appendix F4, 3 vs. 2, pgs. 347 through 358).

The juvenile emigration life stage generally extends from May through September. Similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juvenile emigration. As described in the discussion of the year-round juvenile rearing period, during the warmest months of July and August water temperatures under the CEQA Yuba Accord Alternative would be substantially lower, and therefore potentially more suitable, over nearly the entire cumulative water temperature distributions, and overall would result in 12 decreases below the 66°F index value during the juvenile emigration life stage (Appendix F4, 3 vs. 2, pgs. 199 through 210 and 371 through 382).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding, adult spawning and embryo incubation conditions, because of corresponding upstream migration and spawning flow-related habitat availabilities, and lower and therefore more suitable water temperatures during adult immigration and holding

- Generally equivalent or improved over-summer rearing and juvenile emigration conditions, due to consistently and substantially lower (generally about 1 – 3°F), and therefore potentially more suitable, water temperatures at Marysville

In conclusion, in consideration of potential effects to all life stages of green sturgeon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for green sturgeon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-7: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect American shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Yuba River. Studies conducted on the lower Yuba River suggest that shifting of proportional flows (lower Yuba River flows/lower Feather River flows) may simply re-allocate shad from the Feather River to the lower Yuba River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for American shad attraction into the lower Yuba River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.1 percent higher during April, 1.5 percent lower during May, and 1.4 percent higher during June under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Under the CEQA Yuba Accord Alternative, during wet years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.1 percent higher during April, 0.4 percent higher during May, and 0.7 percent higher during June. During above normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.4 percent higher during April, 0.9 percent higher during May, and 4.5 percent higher during June. During below normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 1.4 percent lower during April, 2.8 percent lower during May, and 0.4 percent higher during June. During dry years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 1.0 percent higher during April, 10.2 percent lower during May, and 0.2 percent higher during June. During critical years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 2.4 percent higher during April, 9.5 percent lower during May, and 0.4 percent lower during June (Appendix F4, 3 vs. 2, pgs. 100 and 272).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Long-term average proportionate flows would be slightly higher during April and June, and slightly lower during May. Also, the lower proportionate flows during May, particularly in dry and critical years, would not be expected to significantly affect American shad attraction into the lower Yuba River because the combined probability of occurrence of dry and critical years is less than one-third, and proportionate flows would be fairly similar during June and higher during April.

Differences in water temperature between the Feather and lower Yuba rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June, American shad adult immigration and spawning life stage the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would result in 8 fewer occurrences (out of 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 3 vs. 2, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide changes in proportionate lower Yuba River to lower Feather River flows, and water temperatures within the reported range of suitable spawning temperatures, that would not unreasonably affect American shad and its habitat.

Impact 10.2.3-8: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Yuba River. Striped bass spawning and initial rearing in the lower Yuba River extends from April through June. Proportionate flow changes resulting from implementation of the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Yuba River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Long-term average proportionate flows would be slightly higher during April and June, and slightly lower during May. The lower proportionate flows during May, particularly in dry and critical years, would not be expected to significantly affect striped bass attraction into and initial rearing in the lower Yuba River because the combined probability of occurrence of dry and critical years is less than one-third, and proportionate flows would be fairly similar during June and higher during April.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 4 additional occurrences (out of 213 months included in the analysis) when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 3 vs. 2, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide changes in proportionate lower Yuba River to lower Feather River flows, and water temperatures within the reported range of suitable spawning and initial rearing water temperatures, that would not unreasonably affect striped bass and its habitat.

10.2.3.2 CVP/SWP UPSTREAM OF THE DELTA REGION

FEATHER RIVER BASIN

Oroville Reservoir

Impact 10.2.3-9: Decreases in Oroville Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Reductions in simulated end-of-month water surface elevation in Oroville Reservoir by more than six feet would occur the same number of times during March and April, two more times during May, and two fewer times during June under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative. These reductions in water surface elevations would not be anticipated to result in substantial reductions in warmwater fish spawning success, because the results suggest that these potential decreases in water surface elevation would not be expected to occur during more than one month of any spawning season. In addition, a 60 percent nest success rate or greater would be achieved during some months of any annual spawning season, which would be expected to provide sufficient recruitment of individuals into the population over the 72-year simulation period. Therefore, the CEQA Yuba Accord Alternative would not unreasonably affect Oroville Reservoir warmwater fisheries resources, and would provide an equivalent or higher level of protection, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 456 through 467).

Impact 10.2.3-10: Decreases in Oroville Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Under the CEQA Yuba Accord Alternative, long-term average end of month storage is essentially equivalent from April through November, relative to the CEQA No Project Alternative. Average end of month storage by water year type would be essentially equivalent for all months of the April through November period, for all water year types with the exception of June. During June in above normal, dry and critical years, Oroville Reservoir storage volumes would be approximately one percent higher under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative. Therefore, potential changes in coldwater pool storage would not be expected to affect Oroville Reservoir's coldwater fisheries because: (1) coldwater habitat would remain available in the reservoir during all months of the CEQA Yuba Accord Alternative; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fish. In conclusion, the CEQA Yuba Accord Alternative would not unreasonably affect Oroville Reservoir coldwater fisheries resources, and would provide an equivalent or higher level of protection, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pg. 406).

Lower Feather River

The following sections describe and discuss flow and water temperature differences between the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, and potential effects on fisheries and aquatic resources in the lower Feather River.

Over the entire simulation period for every month of the year, long-term average flows and water temperatures for all water year types, monthly mean flows and water temperatures, and the cumulative flow and water temperature distributions in the Low Flow Channel below the Fish Barrier Dam would be essentially equivalent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Therefore, evaluations of potential effects in the lower Feather River are restricted to below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River (Appendix F4, 3 vs. 2, pgs. 505 through 517 and 554 through 566).

Impact 10.2.3-11: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The analytical period for adult immigration and holding of spring-run Chinook salmon in the lower Feather River extends from March through October. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative, relative to the flows under the CEQA No Project Alternative would be higher by ten percent or more with a 3 percent probability during May, and a 10 percent probability during July. Flows under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would be lower by ten percent or more 1 percent of the time during April and 25 percent of the time during June. Simulated flows below the Thermalito Afterbay Outlet would essentially equivalent or measurably higher ranging from 70 percent to 100 percent of the time during all months of this life stage with the exception of April and June. During April, measurable flow decreases would occur at intermediate to high flow levels. During June, flow decreases would consistently occur across most of the cumulative flow distribution, but would remain above about 1,500 cfs 90 percent of the time, and above 3,000 cfs more than 70 percent of the time. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 12 percent probability during May and nearly 50 percent probability during July. By contrast, during relatively low flow conditions flows would be lower by 10 percent or more with about a 4 percent probability during April and an 80 percent probability during June (Appendix F4, 3 vs. 2, pgs. 604 through 615 and 628 through 639).

Flows at the mouth of the Feather River would exhibit general similar trends to those observed at the Thermalito Afterbay Outlet location with the notable exceptions of: (1) additional measurable flow increases during October and November, particularly during relatively low flow conditions; (2) measurable flow decreases at intermediate to low flow conditions during May, although flows would remain at or above 2,000 cfs about 95 percent of the time; (3) consistently higher flows over nearly the entire cumulative flow distribution during August; and (4) measurably higher flows during September, particularly during low flow conditions. Fish exhibiting the typical life history of the spring-run are found holding at the Thermalito Afterbay Outlet and the Fish Barrier Dam as early as March (DWR 2004d), and most would be expected to have migrated upstream by June (Appendix F4, 3 vs. 2, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would be generally equivalent over the entire cumulative water temperature distributions during the March through October adult immigration and holding life stage period. The only relatively minor excursion would be during the month of June, when water temperatures under the CEQA Yuba Accord Alternative would be generally equivalent about 90 percent of the time, and would be measurably higher about 10 percent of the time, relative to the CEQA No Project Alternative. Under both alternatives, water temperatures would always remain below the 60°F index value during

March. Water temperatures would remain below the 60°F index value with nearly a 90 percent probability during April, and with about a 15 percent probability during May. From July through September, water temperatures would always exceed the 60°F index value. In fact, water temperatures would exceed the 68°F water temperature index value, and therefore would represent stressful water temperature conditions, with about an 80 and 60 percent probability during July and August, respectively (Appendix F4, 3 vs. 2, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River would be generally warmer than at Thermalito Afterbay Outlet during each month of the March through October adult immigration and holding life stage, particularly during the warm summer months of June through September, when water temperatures at the mouth of the lower Feather River would be frequently 1 – 4°F warmer than at the Thermalito Afterbay Outlet, under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative. At the mouth of the lower Feather River, water temperatures under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would be generally equivalent during March, April, June, September and October. During May, water temperatures would be measurably warmer at intermediate to warm water temperature conditions. During July and August, water temperatures under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would always exceed the 68°F water temperature index value, although water temperatures under the CEQA Yuba Accord Alternative would be consistently about 0.3°F to about 1°F cooler than the CEQA No Project Alternative, when temperatures would be stressful to this species and life stage (Appendix F4, 3 vs. 2, pgs. 825 through 836 and 849 through 860).

Overall, during the entire March through October adult immigration and holding period below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in no changes at the 60°F index value, 1 decrease below the 64°F index value, and 2 increases above the 68°F index value (Appendix F4, 3 vs. 2, pgs. 678 through 689). At the mouth of the Feather River, the CEQA Yuba Accord Alternative would result in 1 decrease below the 60°F index value, no changes at the 64°F index value, and 2 decreases below the 68°F index value, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 825 through 836).

Because no clear distinction between spring- and fall-run Chinook salmon spawning could be derived from survey data collected in the lower Feather River, the spawning habitat analysis for potential impacts on the two runs was combined into one expanded spawning season (September through December) that was inclusive of all Chinook salmon spawning in the lower Feather River. Over the 71-year simulation period, the annual spawning habitat availability long-term average for Chinook salmon spawning in the lower Feather River under the CEQA Yuba Accord Alternative would be similar to that under the CEQA No Project Alternative (long-term average of 85.3 percent versus 85.4 percent of the maximum WUA) (Appendix F4, 3 vs. 2, pg. 873).

The cumulative annual Chinook salmon spawning habitat availabilities under the CEQA Yuba Accord Alternative would be almost undistinguishable from those under the CEQA No Project Alternative. Both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would achieve over 90 percent of maximum WUA with nearly a 30 percent probability, and both alternatives would achieve over 80 percent of maximum WUA with about an 85 percent probability. Changes of 10 percent or more in annual spawning habitat availability would not occur (Appendix F4, 3 vs. 2, pg. 875).

Water temperatures below the Thermalito Afterbay Outlet during September, which represents the earliest month of the spawning period, would be nearly identical between the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, and commonly would exceed water temperatures reported to be suitable for Chinook salmon spawning. For example, under both alternatives, water temperatures below the Thermalito Afterbay Outlet during September would exceed 62°F about 95 percent of the time. Water temperatures under both alternatives also would be nearly identical during October, November and December. Under both alternatives, during October water temperatures would exceed the reported optimum (56°F) for Chinook salmon spawning about 95 percent of the time, whereas water temperatures would remain suitable for spawning during November and December (Appendix F4, 3 vs. 2, pgs. 678 through 689 and 702 through 713).

The embryo incubation life stage for Chinook salmon in the lower Feather River generally extends from September through February. Timing of fry emergence is primarily dependant on water temperature. As illustrated above for the spawning life stage, water temperatures below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be nearly identical to those under the CEQA No Project Alternative during the September through December period. During January and February, water temperatures generally would not exceed 53°F, would not approach the lowest water temperature index value (56°F) and therefore would remain suitable, below the Thermalito Afterbay Outlet under either the CEQA Yuba Accord Alternative or the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 678 through 689 and 702 through 713).

Long-term average early life stage survival estimates would be identical under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative (97.7 percent). Early life stage survival estimates would not differ by more than 0.4 percent for any individual year included in the 71-year period of analysis. Substantial reductions in salmon survival over three or more consecutive years would not be observed between the CEQA Yuba Accord Alternative and the CEQA No Project Alternative. Therefore, the CEQA Yuba Accord Alternative would not be anticipated to affect potential future recruitment from a given spawning stock, which may in turn affect the population dynamics of subsequent generations (Appendix F4, 3 vs. 2, pg. 881).

Spring-run Chinook salmon juveniles are commonly reported to rear in their natal streams from 9 to 18 months. Specific habitat-discharge relationships for juvenile Chinook salmon rearing have not been developed for the lower Feather River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to Chinook salmon juveniles. Therefore, for impact assessment purposes, year-round examination of water temperatures is conducted to address potential juvenile spring-run Chinook salmon rearing in the lower Feather River.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be nearly identical to those under the CEQA No Project Alternative over the entire cumulative water temperature distributions during each month of the year-round juvenile rearing period. From November through April, water temperatures generally would remain below 60°F under both alternatives. Water temperatures during May would remain at or below 65°F nearly 90 percent of the time. Water temperatures would exceed 65°F about 80 percent of the time during June, would always exceed 65°F during July and August, and would exceed 65°F during September about 50 percent of the time. Water temperatures are considered to be particularly stressful to rearing juvenile Chinook salmon during July and August, when water temperatures would exceed about 70°F nearly 40 percent of the time. Overall, during the year-round juvenile Chinook salmon rearing life stage below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in no change at the 60°F index value, 1 decrease below the 63°F index value, 1 decrease below the 65°F index value, 2 increases above the 68°F index value, and no change at the 70°F or 75°F index values (Appendix F4, 3 vs. 2, pgs. 678 through 689 and 702 through 713).

Spring-run Chinook salmon smolt emigration reportedly occurs from October through June. Flows below the Thermalito Afterbay Outlet during October and November would be essentially equivalent or measurably higher over nearly the entire cumulative flow distributions. During December and January, flows would be generally equivalent or measurably higher with about an 85 percent probability. During February and March, flows would be essentially equivalent or measurably higher nearly 95 percent of the time. During April below the Thermalito Afterbay Outlet, measurable flow decreases would occur at intermediate to high flow levels under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. These flow reductions at the intermediate to high flow levels would not be expected to substantively affect spring-run Chinook salmon smolt emigration habitat conditions. During May, flow increases generally would occur at low to intermediate flow levels. During June, flow decreases consistently would occur across most of the cumulative flow distributions, but would remain above about 1,500 cfs 90 percent of the time, and above 3,000 cfs more than 70 percent of the time (Appendix F4, 3 vs. 2, pgs. 604 through 615 and 628 through 639).

Simulated flows below the Thermalito Afterbay Outlet would not change by ten percent or more with greater than a 3 percent probability during any month of the smolt emigration life stage, with the exception of June. During June, flows under the CEQA Yuba Accord Alternative would be lower by ten percent or more with about a 25 percent probability. During relatively low flow conditions, flows would be higher by ten percent or more with about a 12 percent probability during May under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. By contrast, during relatively low flow conditions, flows would be lower by ten percent or more with about a 4 percent probability during April and an 80 percent probability during June (Appendix F4, 3 vs. 2, pgs. 604 through 615 and 628 through 639).

During the smolt emigration period, flows at the mouth of the Feather River would exhibit general similar trends to those observed at the Thermalito Afterbay Outlet location with the notable exceptions of: (1) additional measurable flow increases during October and November, particularly during relatively low flow conditions; (2) measurable flow reductions at intermediate and high flow levels during December and January; (3) additional flow decreases during February and March resulting in essentially equivalent flows 60 and 70 percent of the time, with measurably lower flows about 30 and 20 percent of the time, respectively; and (4) measurable flow decreases at intermediate to low flow conditions during May, although flows would remain at or above 2,000 cfs about 95 percent of the time (Appendix F4, 3 vs. 2, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would generally be equivalent over the entire cumulative water temperature distributions during the October through June smolt emigration life stage period. The only relatively minor excursion would be during the month of June, when water temperatures under the CEQA Yuba Accord Alternative would generally be equivalent about 90 percent of the time, and would be measurably higher about 10 percent of the time, relative to the CEQA No Project Alternative. Under both alternatives, water temperatures would always remain below the 60°F index value (and therefore would remain suitable) from November through March. Water temperatures would remain below the 60°F index value with nearly a 60 and 90 percent probability during October and April, respectively. Water temperatures would exceed the 60°F index value with about an 85 percent probability during May, and would always exceed 60°F during June (Appendix F4, 3 vs. 2, pgs. 678 through 689 and 702 through 713).

With the exception of the winter months of November through February when water temperatures would remain cool (< 56°F), water temperatures at the mouth of the Feather River would be warmer than at Thermalito Afterbay Outlet during the October through June smolt emigration life stage. At the mouth of the lower Feather River, water temperatures under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would generally be equivalent during October, March, April and June. During intermediate to warm water temperature conditions, water temperatures would be measurably warmer during May, which generally would correspond to "drier" water year types (Appendix F4, 3 vs. 2, pgs. 825 through 836 and 849 through 860).

Overall, during the entire October through June smolt emigration period below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in no changes at the 60°F index value, 1 decrease below the 63°F index value, 2 increases above the 68°F index value, and no changes at the 70°F index value (Appendix F4, 3 vs. 2, pgs. 678 through 689). At the mouth of the Feather River, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would result in 1 decrease below the 60°F index value, 1 increase above the 63°F index value, 2 increases above the 68°F index value, and 2 decreases below the 70°F index value (Appendix F4, 3 vs. 2, pgs. 825 through 836).

The most notable trends in flow and water temperature conditions during the smolt emigration period would be: (1) flow reductions primarily occurring at intermediate to low flow conditions during May and June; and (2) measurably warmer water temperatures during May and June. This trend may not substantively affect spring-run Chinook salmon smolt emigration because: (1) as discussed above under the lower Yuba River spring-run Chinook salmon smolt emigration discussion, this flow pattern may accommodate the emigration of juvenile spring-run Chinook salmon before warm water temperatures would occur during late spring in drier water years in the lower portion of the lower Feather River; and (2) in the Feather River, data on juvenile Chinook salmon emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run emigration (DWR and Reclamation 1999; Painter *et al.* 1977).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent adult immigration and holding conditions, because of: (1) equivalent or measurably higher flows ranging from 70 percent to 100 percent of the time during all months of this life stage with the exception of April and June below the Thermalito Afterbay Outlet; (2) during April, measurable flow decreases at intermediate to high flow levels, and during June flow decreases across most of the cumulative flow distribution, but remaining above about 1,500 cfs 90 percent of the time, and above 3,000 cfs more than 70 percent of the time below the Thermalito

Afterbay Outlet; and (3) water temperatures are consistently about 0.3 to about 1°F cooler at the mouth of the Feather River, when temperatures are stressful to this species and life stage

- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period, and nearly identical water temperatures below the Thermalito Afterbay Outlet
- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates
- Equivalent or potentially more suitable juvenile rearing conditions due to nearly identical water temperatures below the Thermalito Afterbay Outlet, and substantially cooler, and therefore more suitable, water temperatures at the mouth of the lower Feather River during the warmest and most stressful months of July and August
- Generally equivalent smolt emigration conditions due to generally equivalent flow and water temperature conditions with the exception of flow reductions primarily occurring at intermediate to low flow conditions during May and June, and measurably warmer water temperatures during May and June. This trend may not substantively affect spring-run Chinook salmon smolt emigration because: (1) as discussed above under the lower Yuba River spring-run Chinook salmon smolt emigration discussion, this flow pattern may accommodate the emigration of juvenile spring-run Chinook salmon before warm water temperatures occur during late spring in drier water years in the lower portion of the lower Feather River; and (2) in the Feather River, data on juvenile Chinook salmon emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run emigration (DWR and Reclamation 1999; Painter *et al.* 1977).

In conclusion, in consideration of potential effects to all life stages of spring-run Chinook salmon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent level of protection for spring-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-12: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The analytical period for adult immigration and holding of fall-run Chinook salmon in the Feather River extends from July through December. The flows under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative during March through October are described in the discussion provided above for spring-run Chinook salmon adult immigration and holding. That discussion concludes that the flows under the CEQA Yuba Accord Alternative would provide generally equivalent adult immigration and holding conditions for spring-run Chinook salmon, relative to the CEQA No Project Alternative flows. During November and December, which are the only months during the fall-run Chinook salmon adult immigration and holding life stage period that do not overlap with the spring-run Chinook salmon adult immigration and holding period, flows at Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be essentially equivalent to or higher than the flows under the CEQA No Project Alternative over nearly the entire cumulative flow distribution during November, and about 85 percent of the distribution in December (Appendix F4, 3 vs. 2, pgs. 628 through 639). At the mouth of the Feather River, flows under the CEQA Yuba Accord Alternative would be essentially equivalent or higher than flows under the CEQA No Project

Alternative over about 85 percent of the cumulative flow distribution during November, and over about 45 percent in December. During December, flows would be lower at intermediate to high flows (e.g., when flows are greater than about 3,000 cfs). Therefore, flows under the CEQA Yuba Accord Alternative would be expected to provide generally equivalent adult immigration and holding conditions for fall-run Chinook salmon, relative to the CEQA No Project Alternative (Appendix F4, 3 vs.2, pgs. 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would be generally equivalent over the entire cumulative water temperature distributions during the July through December adult immigration and holding life stage period. The only relatively minor excursions would be during the months of July and September, when water temperatures under the CEQA Yuba Accord Alternative would be measurably warmer for about 4 percent of the cumulative distribution and would be measurably cooler for about 1 percent of the cumulative distribution, respectively, relative to the CEQA No Project Alternative. Under both alternatives, water temperatures nearly always would exceed the 60°F index value from July through September, would remain below the 60°F index value with about a 60 percent probability during October, and would always remain below the 60°F index value during November and December. Under both alternatives, water temperatures would exceed the 68°F water temperature index value with about an 80 percent probability, 60 percent probability, and 3 percent probability during July, August, and September, respectively (Appendix F4, 3 vs. 2, pgs. 702 through 713 and 678 through 689).

Water temperatures at the mouth of the Feather River would generally be warmer than at Thermalito Afterbay Outlet during each month of the July through December adult immigration and holding life stage, particularly during the warm summer months of July through September, when water temperatures at the mouth of the Feather River would be frequently 1 – 4°F warmer than at the Thermalito Afterbay Outlet, under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative. At the mouth of the Feather River, during July and August, water temperatures under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would always exceed the 68°F water temperature index value, although water temperatures under the CEQA Yuba Accord Alternative would be consistently about 0.3 to about 1°F cooler than the CEQA No Project Alternative, when temperatures would be stressful to this species and life stage. Water temperatures at the mouth of the Feather River under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would nearly always be essentially equivalent from September through December (Appendix F4, 3 vs. 2, pgs. 825 through 836 and 849 through 860).

Overall, during the entire July through December adult immigration and holding period below the Thermalito Afterbay Outlet and at the mouth of the Feather River, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in no changes at the 60°F index value, 1 decrease below the 64°F index value, and no changes at the 68°F index value (Appendix G, 3 vs. 2, pgs. G-27 through G-28).

The adult spawning and embryo incubation life stage periodicities of fall-run Chinook salmon in the Feather River are not distinguished from those of the spring-run; therefore these life stages are not evaluated separately. For evaluation of Chinook salmon spawning and embryo incubation under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, see the discussion provided above under spring-run Chinook salmon.

The analytical period for fall-run Chinook salmon juvenile rearing and outmigration on the Feather River extends from November through June. The flows under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative during October through June are described in detail in the discussion provided above for spring-run Chinook salmon smolt emigration. That discussion suggests that the relative flow differences between the operational alternatives during the October through June period would not be expected to substantially affect spring-run Chinook salmon smolt emigration. Therefore, because the fall-run Chinook salmon juvenile outmigration period (November through June) is encompassed within the spring-run Chinook salmon smolt emigration period (October through June), the flow differences from fall through spring also would not be expected to have substantial effects on fall-run Chinook salmon juvenile outmigration.

Specific habitat-discharge relationships for juvenile Chinook salmon rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, water temperatures may be a primary stressor to rearing Chinook salmon juveniles. Therefore, for impact assessment purposes, an examination of water temperatures during November through June is conducted to address potential impacts to juvenile fall-run Chinook salmon rearing in the Feather River. This examination also applies to juveniles migrating downstream because the thermal requirements of fall-run Chinook salmon juveniles are equivalent whether the juveniles are rearing or migrating downstream.

Simulated water temperatures under both alternatives would be generally similar for each month of this life stage. From November through April, water temperatures at the Thermalito Afterbay Outlet generally would remain below 60°F under both alternatives. Water temperatures during May would remain at or below 65°F with nearly a 90 percent probability, whereas during June water temperatures would exceed 65°F with about an 80 percent probability. The CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would result in no changes at the 60°F index value, 1 decrease below the 63°F index value, 1 decrease below the 65°F index value, 2 increases above the 68°F index value, and no changes at the 70°F or 75°F index values (Appendix F4, 3 vs. 2, pgs. 678 through 689 and 702 through 713).

Simulated water temperatures under both alternatives at the mouth of the Feather River would be generally similar from November through April, and in June. During May, water temperatures under the CEQA Yuba Accord Alternative would be slightly warmer than under the CEQA No Project Alternative. Water temperatures are considered to be particularly stressful to rearing juvenile Chinook salmon during June, when water temperatures would exceed 70°F with about a 55 percent probability under the CEQA Yuba Accord Alternative and with about a 60 percent probability under the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 849 through 860). Overall, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would result in no changes at the 60°F index value, 1 increase above the 63°F index value, no changes at the 65°F index value, 2 increases above the 68°F index value, and no changes at the 70°F or 75°F index values (Appendix F4, 3 vs.2, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent, and potentially more suitable adult immigration and holding conditions, because of: (1) generally similar flows at Thermalito Afterbay Outlet and at the mouth of the Feather River during most months of this life stage (July through

December); and (2) water temperatures are consistently about 0.3 to about 1°F cooler at the mouth of the Feather River, when temperatures are stressful to this species and life stage.

- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period, and nearly identical water temperatures below the Thermalito Afterbay Outlet
- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates
- Equivalent rearing and outmigration conditions due to: (1) essentially equivalent flows at Thermalito Afterbay Outlet and at the mouth of the Feather River for most months during November through June, which provides similar outmigration conditions; and (2) essentially equivalent water temperatures for juvenile rearing below the Thermalito Afterbay Outlet and at the mouth of the Feather River for most months from November through June.

In conclusion, in consideration of potential effects to all life stages of fall-run Chinook salmon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent level of protection for fall-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-13: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the Feather River extends from August through April. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would be essentially equivalent or measurably higher ranging from about a 70 percent to 100 percent probability all months of this life stage. Flows also would be generally equivalent during low flow conditions, with flow differences of ten percent or more only occurring in February and April with about a 4 percent probability (Appendix F4, 3 vs. 2, pgs. 604 through 615 and 628 through 639).

At the mouth of the Feather River, simulated flows under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would be essentially equivalent or measurably higher with a probability ranging from about 70 percent to 98 percent during August through April, with the exceptions of December and January. During December and January, flows would be measurably lower with about a 50 percent and 60 percent probability, respectively; however, the flow reductions would occur when flows are greater than 2,000 cfs, and therefore would not be expected to substantially affect steelhead adult immigration and holding (Appendix F4, 3 vs. 2, pgs. 776 through 787 and 800 through 811).

The CEQA Yuba Accord Alternative would be expected to provide a somewhat cooler and therefore more suitable thermal regime for steelhead adult immigration and holding, relative to the CEQA No Project Alternative. For example, water temperatures at Thermalito Afterbay Outlet and at the mouth of the Feather River under both alternatives would be essentially equivalent for at least 96 percent of the cumulative water temperature distribution for each month from August through April. The only exception to this would be during August at the mouth of the Feather River, when water temperatures would be measurably cooler under the CEQA Yuba Accord Alternative with about a 99 percent probability, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 702 through 713 and 800 through 811). Overall, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would result in no changes at either the 52°F or 56°F index values and 11 decreases below the 70°F index value (Appendix G, 3 vs. 2, pg. G-28).

The steelhead spawning season in the Feather River generally extends from December through March. During this life stage, the long-term average annual spawning habitat availability under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would be about 55.4 percent of maximum WUA. Both alternatives would achieve over 90 percent of maximum WUA with about an 11 percent probability. No changes of 10 percent or more in spawning habitat availability would occur over the cumulative WUA distributions (Appendix F4, 3 vs. 2, pgs. 876 and 878).

From December through March, water temperatures at Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be essentially equivalent to water temperatures under the CEQA No Project Alternative. Overall, during the adult spawning life stage, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would not result in changes at any of the steelhead spawning water temperature index values (Appendix F4, 3 vs. 2, pgs. 678 through 689).

The embryo incubation period for steelhead in the Feather River generally overlaps with the spawning period, but extends into May. During April and May, water temperatures at Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be essentially equivalent to the water temperatures under the CEQA No Project Alternative except for 2 percent of the cumulative water temperature distribution in May, when water temperatures would be measurably warmer by up to 0.4°F. Overall, during the embryo incubation life stage at the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 1 decrease below the 54°F index value and no changes at the 52°F, 57°F, or 60°F index values (Appendix F4, 3 vs. 2, pgs. 702 through 713).

Steelhead juveniles are believed to rear in the Feather River year-round. Specific habitat-discharge relationships for juvenile rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be nearly identical to those under the CEQA No Project Alternative over the entire cumulative water temperature distributions during each month of the year-round juvenile rearing period. From November through April, water temperatures generally would remain below 60°F under both alternatives. Water temperatures during May would remain at or below 65°F nearly 90 percent of the time, whereas during June water temperatures would exceed 65°F about 80 percent of the time, would always exceed 65°F during July and August, and would exceed 65°F during September about 50 percent of the time. Water temperatures are considered to be particularly stressful to rearing steelhead during July and August, when water temperatures would exceed about 70°F nearly 40 percent of the time. Overall, during the year-round steelhead rearing life stage below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 1 decrease below the 65°F index value, 2 increases above the 68°F index value, and no changes at the 72°F or 75°F index values (Appendix F4, 3 vs. 2, pgs. 702 through 713).

The Feather River steelhead smolt emigration analytical period is believed to extend from October through May. The flows under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative during October through June are described in detail in the discussion provided above for spring-run Chinook salmon smolt emigration. That discussion suggests that the relative flow differences between the operational alternatives during the October through June period would not be expected to substantially affect spring-run Chinook salmon smolt emigration. Therefore, because the steelhead smolt emigration period (October through May) is encompassed within the spring-run Chinook salmon smolt emigration period (October through June), the flow differences from fall through spring also would not be expected to have substantial effects on steelhead smolt emigration.

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would be generally equivalent over the entire cumulative water temperature distributions during the October through May smolt emigration life stage period. With the exception of the winter months of November through February when water temperatures would remain cool (< 56°F), water temperatures at the mouth of the Feather River would be warmer than at Thermalito Afterbay Outlet during the October through May smolt emigration life stage. At the mouth of the Feather River, water temperatures under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would be generally equivalent during October, March, and April. During intermediate to warm water temperature conditions, water temperatures would be measurably warmer (by up to 0.8°F) during May, which generally would correspond to "drier" water year types (Appendix F4, 3 vs. 2, pgs. 678 through 689, 702 through 713, 825 through 836, and 849 through 860).

Overall, during the entire October through May smolt emigration period below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in no changes at the 52°F, 55°F, and 59°F index values (Appendix F4, 3 vs. 2, pgs. 678 through 689). At the mouth of the Feather River, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would result in no changes at the 52°F index value, 1 increase above the 55°F index value, and 1 increase above the 59°F index value (Appendix F4, 3 vs. 2, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding conditions, because of: (1) essentially equivalent or slightly higher flows at Thermalito Afterbay Outlet and at the mouth of the Feather River; (2) similar holding habitat conditions; and (3) essentially equivalent or slightly cooler water temperatures during the warm late summer and early fall months in the lower section of the river

- Equivalent spawning habitat availability, and essentially equivalent water temperatures at Thermalito Afterbay Outlet during the December through March adult spawning period

- Essentially equivalent water temperatures at Thermalito Afterbay Outlet over nearly the entire embryo incubation period

- Essentially equivalent water temperatures at Thermalito Afterbay Outlet over nearly the entire year-round juvenile rearing period
- Generally equivalent smolt emigration conditions during the majority of the smolt emigration period (October through May), with lower flows during relatively low flow conditions in May.

In conclusion, in consideration of potential effects to all life stages of steelhead, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent level of protection for steelhead and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-14: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect green sturgeon

The analytical period for green sturgeon adult immigration and holding extends from February through July. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would be essentially equivalent or higher ranging from about a 90 percent to 100 percent probability all months of this life stage with the exception of April and June. During April and June, flow decreases would occur at low to intermediate flow conditions, but would remain above 1,500 cfs for about 50 and 90 percent of the distribution, respectively. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative, relative to under the CEQA No Project Alternative would be higher by ten percent or more during this life stage with about a 1 percent probability in February, a 3 percent probability in May, and about a 10 percent probability during July. Under the CEQA Yuba Accord Alternative water temperatures are lower by ten percent or more with about a 1 percent probability during April and about a 24 percent probability during June, relative to the CEQA No Project Alternative. During relatively low flow conditions, flows would be higher by ten percent or more with about a 4 percent probability during February, about a 10 percent probability in May, and about a 50 percent probability in July. Conversely, during relatively low flow conditions, flows would be lower by ten percent or more with about a 4 percent probability in April and about an 80 percent probability during June (Appendix F4, 3 vs. 2, pgs. 628 through 639 and 702 through 713).

This temporal trend in flow changes also would occur at Shanghai Bench and at the mouth of the Feather River, with the exception that flows during low to intermediate flow conditions in April, May, and June would generally be lower under the CEQA Yuba Accord Alternative than under the CEQA No Project Alternative. For example, during low flow conditions at Shanghai Bench, flows would be lower by ten percent or more with about a 75 percent probability during May and about a 65 percent probability during June. Based on the frequency and magnitude of the flow changes observed in the monthly mean flow data, as well as in the data for long-term average flows, average flows by water year type, and flow exceedance, flows during the green sturgeon immigration and holding life stage would be expected to provide similar conditions for upstream migration and holding under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 751 through 762 and 800 through 811).

Because the analytical period for green sturgeon spawning (i.e., March through July) falls within the adult immigration and holding analytical period, flows under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative also would be expected to provide similar conditions for the spawning life stage.

Relative to the CEQA No Project Alternative, water temperatures under the CEQA Yuba Accord Alternative would be expected to provide similar conditions during each of the adult immigration and holding, spawning, and embryo incubation life stages. From February through July at Thermalito Afterbay Outlet, water temperatures under both alternatives would be essentially equivalent with a probability of at least 90 percent. At the mouth of the Feather River, water temperatures during these months under both alternatives would be essentially equivalent or measurably cooler with a probability of at least 95 percent with the exception of May, when water temperatures would be measurably warmer at primarily intermediate to warm conditions for about 35 percent of the cumulative water temperature distribution (Appendix F4, 3 vs. 2, pgs. 849 through 860). During the adult immigration and holding life stage at the Thermalito Afterbay Outlet and at the mouth of the Feather River, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would result in one increase above the 61°F index value and no changes at other index values. During the adult spawning and embryo incubation life stages, which are evaluated at the Thermalito Afterbay Outlet, but not at the mouth of the Feather River, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would result in four increases above the 68°F index value and no changes at other index values (Appendix F4, 3 vs. 2, pgs. 678 through 689 and 825 through 836).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Specific habitat-discharge relationships for green sturgeon juvenile rearing have not been developed for the Feather River. Year-round flows below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River have been generally described above under the spring-run Chinook salmon, fall-run Chinook salmon, and steelhead life stage evaluations. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juveniles.

Relative to the CEQA No Project Alternative, water temperatures under the CEQA Yuba Accord Alternative would be expected to provide similar conditions during the juvenile rearing life stage. Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would generally be equivalent to those under the CEQA No Project Alternative over the entire cumulative water temperature distributions during each month of the year-round juvenile rearing period. For example, the water temperatures at this location under the alternatives would be essentially equivalent for at least 90 percent of the cumulative water temperature distribution during any given month (Appendix F4, 3 vs. 2, pgs. 702 through 713). Simulated water temperatures at the mouth of the Feather River under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would be generally similar from September through April, would be slightly warmer during May and June, and would be cooler during July and August. Overall, during the year-round juvenile green sturgeon rearing life stage, the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative would result in 5 increases above the 66°F index value and no changes at other index values (Appendix F4, 3 vs. 2, pgs. 849 through 860).

The analytical period for the juvenile emigration life stage extends from May through September. Trends in flows during this life stage are encompassed in the description above for spring-run Chinook salmon adult immigration and holding. Also, similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juvenile emigration. As described in the discussion for juvenile rearing, the CEQA Yuba Accord Alternative would be expected to provide generally similar water temperature conditions year-round.

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent adult immigration and holding, adult spawning and embryo incubation conditions, because of corresponding upstream migration and spawning flow-related habitat availabilities, and suitable water temperatures during adult immigration and holding
- Generally equivalent over-summer rearing and juvenile emigration conditions, due to generally equivalent water temperatures

In conclusion, in consideration of potential effects to all life stages of green sturgeon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent level of protection for green sturgeon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-15: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect American Shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Feather River. As discussed above for lower Yuba River American shad, shifting of proportional flows (lower Feather River flows/Sacramento River flows) may simply re-allocate shad from the Sacramento River to the lower Feather River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for American shad attraction into the lower Feather River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Feather River flow, measured at its mouth, to Sacramento River flow, measured downstream of its confluence with the Feather River, would be 0.1 percent lower during April, 0.4 percent lower during May, and 0.7 percent lower during June under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Under the CEQA Yuba Accord Alternative, during wet and above normal years the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.1 percent higher during May, with no change in April and June. During below normal years the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.8 percent lower during April, 1.2 percent lower during May, and 0.3 percent lower during June. During dry years, the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 1.0 percent lower during April, 2.6 percent lower during May, and 1.9 percent lower during June. During critical years, the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.2 percent higher during April, 1.4 percent lower during May, and 4.1 percent lower during June (Appendix F4, 3 vs. 2, pgs. 775 and 882).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. The lower proportionate flows in April through June, particularly in dry and critical years, would not be expected to significantly affect American shad attraction into the lower Feather River because the combined probability of occurrence of dry and critical years is less than one-third of the time, and because proportionate flows would be fairly similar in wet and above normal years.

Differences in water temperature between the Sacramento and lower Feather rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in no changes at the 60°F index value, in 2 decreases below the 70°F index value at Feather River Mouth, out of the 213 months included in the analysis (Appendix F4, 3 vs. 2, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide changes in proportionate lower Feather River to Sacramento River flows, and water temperatures within the reported range of suitable spawning temperatures, that would not unreasonably affect American shad and its habitat.

Impact 10.2.3-16: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Feather River. Striped bass spawning and initial rearing in the lower Feather River extends from April through June. Proportionate flow changes resulting from implementation of the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Feather River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. The lower proportionate flows in April through June, particularly in dry and critical years, would not be expected to significantly affect striped bass attraction into, and spawning and initial rearing in, the lower Feather River because the combined probability of occurrence of dry and critical years is less than one-third of the time, and because proportionate flows would be fairly similar in wet and above normal years.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 2 fewer occurrences when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at mouth of the Feather River (Appendix F4, 3 vs. 2, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide changes in proportionate lower Feather River to Sacramento River flows, and water temperatures within the reported range of suitable spawning and initial rearing water temperatures, that would not unreasonably affect striped bass and its habitat.

Impact 10.2.3-17: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail spawning, embryo incubation, and initial rearing life stages in the lower Feather River occur from February through May. Over the entire 72-year period of simulated February through May estimates of usable flooded area (UFA), long-term average UFA in the lower Feather River would be 0.4 percent lower under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, with average estimates of UFA by water year type ranging from 0.2 percent higher during below normal years to 1.5 percent lower during above normal years. Changes of 10 percent or more in UFA would not occur over more than 10 percent of the cumulative UFA distributions (Appendix F4, 3 vs. 2, pgs. 879 through 880).

Over the entire 71-year simulation period, February through May monthly mean water temperatures below the Thermalito Afterbay Outlet, under both the CEQA Yuba Accord Alternative and CEQA No Project Alternative would remain within the 45 - 75°F range of water temperatures reported to be suitable for splittail spawning (Appendix F4, 3 vs. 2, pgs. 825 through 836).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide generally equivalent conditions for Sacramento splittail in the lower Feather River. In conclusion, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent level of protection for Sacramento splittail and its habitat, relative to the CEQA No Project Alternative.

SACRAMENTO RIVER BASIN

Sacramento River

The following sections describe and discuss flow and water temperature differences between the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, and potential effects on fisheries and aquatic resources in the Sacramento River immediately downstream of the Feather River confluence and at Freeport.

As discussed in the Modeling Technical Memorandum (Appendix D), underlying assumptions within the hydrologic modeling used to characterize potential effects of the CEQA Yuba Accord Alternative and the CEQA No Project Alternative prohibit the re-operation of Shasta Reservoir in response to water transfers from, and flow requirements in the Yuba River. Model results confirmed that monthly mean flows and water temperatures in the Sacramento River would remain identical under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative for all locations upstream of the confluence with the Feather River. Because flows and water temperatures in the Sacramento River upstream of the Feather River confluence would not be likely to be affected by the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, no impacts would be anticipated to occur to any aquatic resource in the Sacramento River upstream of the confluence with the Feather River (Appendix F4, 3 vs. 2, pgs. 907 through 918 and 1030 through 1041).

While flows in the Sacramento River immediately downstream of the Feather River confluence would be expected to change in response to alterations in upstream operations in the Yuba and Feather rivers, model output demonstrates relatively minor and infrequent, but measurable changes in flows. For example, over the 864 months simulated for the Sacramento River immediately below the Feather River confluence, only five monthly mean flows would illustrate a 10 percent or greater change under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative – three decreases of 12.4, 12.5, and 13.6 percent which would occur in June, and two increases of 10.4 and 12.7 percent which would occur in July. The cumulative flow distributions for the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would demonstrate essentially identical flows in February, March, April and September, slightly lower flows in December and January, measurable but slight (generally < 5 percent) flow decreases at low to intermediate flow levels during May and June, measurable but slight (generally < 5 percent) flow increases nearly all of the time during July and August, and slight (generally < 5 percent) flow increases about 60 percent of the time during October and during nearly 20 percent of the lowest flow conditions during November (Appendix F4, 3 vs. 2, pgs. 883 through 894 and 1006 through 1017). Similar results would be evident in the Sacramento River at Freeport, with three June monthly mean flows presenting 10 percent or greater decreases (11.7, 11.3 and 11.4 percent), and one July monthly mean flow presenting a 10 percent increase under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 1030 through 1041).

Water temperatures in the Sacramento River immediately downstream of the Feather River confluence generally would remain similar under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative during most months. In fact, of the 852 months simulated below the Feather River confluence, only three months would illustrate measurably warmer (> 0.3°F) water temperatures under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, including water temperature increases during March and May that would not exceed 0.5°F. By contrast, water temperatures would be measurably cooler (< 0.3°F) under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative in 41 months of the 852 months simulated, including water temperature decreases during May, June and July that would not exceed 0.5°F, and 33 water temperature decreases during August that would not exceed 0.8°F (Appendix F4, 3 vs. 2, pgs. 957 through 968). At Freeport, water temperatures would remain essentially equivalent over the entire year, with the exception of August that would present measurably cooler water temperatures in four of the 71 years simulated (Appendix F4, 3 vs. 2, pgs. 1055 through 1066).

With the exception of May, June, July and August, flows and water temperatures simulated at the lower Feather River confluence and at Freeport under the CEQA Yuba Accord would generally be equivalent to those under the CEQA No Project Alternative. During May and June, flows under the CEQA Yuba Accord Alternative would be consistently but slightly lower than under the CEQA No Project Alternative, with almost equivalent water temperatures. By contrast, during July and August flows under the CEQA Yuba Accord Alternative would be consistently but slightly higher than under the CEQA No Project Alternative, with consistently lower water temperatures.

Impact 10.2.3-18: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect winter-run Chinook salmon

The winter-run Chinook salmon adult immigration and holding life stage occurs in the Sacramento River from December through July. The flow and water temperature differences described above for May, June and July, between the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would not be expected to substantially affect the Sacramento River winter-run Chinook salmon adult immigration and holding life stage because:

- By May, the majority of adult winter-run Chinook salmon returning to the Sacramento River to spawn would have already migrated upstream of the lower Feather River confluence;
- Only relatively minor flow decreases would occur during May and June, and equally minor increases would occur nearly all of the time during July at the lower Feather River confluence (Appendix F4, 3 vs. 2, pgs. 883 through 894); and
- Generally equivalent water temperatures at the lower Feather River confluence and at Freeport throughout this life stage, with a few slight and infrequent overall water temperature reductions during May, June, and July at the confluence of the lower Feather River (Appendix F4, 3 vs. 2, pgs. 957 through 968 and 1055 through 1066).

The juvenile rearing and outmigration life stage extends from June through April. During June, flows under the CEQA Yuba Accord Alternative would be consistently but slightly lower than under the CEQA No Project Alternative, with almost equivalent water temperatures. During July and August, flows under the CEQA Yuba Accord Alternative would be consistently but slightly higher than under the CEQA No Project Alternative, with consistently lower water temperatures. In August, during the warmest 25 percent of the cumulative water temperature distribution, water temperatures under the CEQA Yuba Accord Alternative, relative to those under the CEQA No Project Alternative, would be measurably lower 32 percent of the time at the lower Feather River confluence, and 8 percent of the time at Freeport. Although higher flows and cooler water temperatures may be beneficial, the differences between the alternatives would be relatively minor and would not be expected to substantially affect juvenile rearing and outmigration (Appendix F4, 3 vs. 2, pgs. 883 through 894, 957 through 968, 1006 through 1007, 1055 through 1066, and Appendix G, 3 vs. 2, pg. G-36).

In conclusion, in consideration of potential effects to all relevant life stages of winter-run Chinook salmon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for winter-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-19: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

Spring-run Chinook salmon adult immigration and holding extends from February through September. As discussed above, while relatively minor changes would occur in flows and/or water temperatures during May, June, July and August, during February, March, April and September, flows and water temperatures simulated at the lower Feather River confluence and at Freeport under the CEQA Yuba Accord Alternative would generally be equivalent to those under the CEQA No Project Alternative. In August, during the warmest 25 percent of the cumulative water temperature distribution, water temperatures under the CEQA Yuba Accord Alternative, relative to those under the CEQA No Project Alternative, would be measurably lower 32 percent of the time at the lower Feather River confluence, and 8 percent of the time at Freeport. Moreover, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in no increases above or decreases below the 60°F, 64°F and 68°F index values, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 3 vs. 2, pgs. 883 through 894, 957 through 968, 1006 through 1017, and 1055 through 1066). The CEQA Yuba Accord relatively consistent slightly lower flows and almost equivalent water temperatures during May and June, together with the consistent slightly higher flows and consistently lower water temperatures during July and August, would probably not be of sufficient magnitude and/or frequency to substantively affect adult immigration and holding (Appendix G, 3 vs. 2, pg. G-38).

Juvenile rearing occurs year-round in the lower Feather River, and smolt emigration occurs from October through June. Based on the flow and water temperature modeling results described above, the relatively minor changes that would occur in flows and water temperatures would not be expected to substantially affect spring-run Chinook salmon juvenile rearing and smolt emigration (Appendix F4, 3 vs. 2, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of spring-run Chinook salmon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for spring-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-20: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

Fall-run Chinook salmon adult immigration and holding extends from July through December, and juvenile rearing and outmigration extends from December through June. As discussed above, the relatively equivalent flows and water temperatures from September through April, and the relatively consistent slightly lower flows and almost equivalent water temperatures during May and June, together with the consistent slightly higher flows and consistently lower water temperatures during July and August under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not be expected to substantially affect adult immigration and holding, or juvenile rearing and outmigration (Appendix F4, 3 vs. 2, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of fall-run Chinook salmon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for fall-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-21: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect late fall-run Chinook salmon

Late fall-run Chinook salmon adult immigration and holding extends from October through April, and juvenile rearing and outmigration extends from April through December. Based on the flow and water temperature modeling results under the CEQA Yuba Accord Alternative relative to the No Project Alternative described above, the relatively consistent slightly lower flows and almost equivalent water temperatures during May and June, together with the consistent slightly higher flows and consistently lower water temperatures during July and August, and the relatively equivalent flows and water temperatures during the remaining months would not be expected to substantially affect late fall-run Chinook salmon adult immigration and holding, or juvenile rearing and outmigration (Appendix F4, 3 vs. 2, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of late fall-run Chinook salmon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for late fall-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-22: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect steelhead

In the Sacramento River, the steelhead adult immigration and holding life stage period extends from August through March, the juvenile rearing life stage occurs year-round, and the smolt emigration life stage extends from October through May. Overall, immediately downstream of the Feather River confluence, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 2 decreases below the 70°F index value during the adult immigration and holding life stage, and 2 decreases below the 72°F index values during the juvenile rearing life stage (Appendix F4, 3 vs. 2, pgs. 957 through 968). At Freeport, for the 568 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in 1 decrease below the 70°F index value during the adult immigration and holding life stage (Appendix F4, 3 vs. 2, pgs. 1055 through 1066).

Based on the flow and water temperature modeling results under the CEQA Yuba Accord Alternative relative to the No Project Alternative discussed above, the relatively consistent slightly lower flows and almost equivalent water temperatures during May and June, together with the consistent slightly higher flows and consistently lower water temperatures during July and August, and the relatively equivalent flows and water temperatures during the remaining months would not be expected to substantially affect steelhead adult immigration and holding, juvenile rearing, or smolt emigration (Appendix F4, 3 vs. 2, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of steelhead, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for steelhead and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-23: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect green sturgeon

Green sturgeon adult immigration and holding extends from February through July, adult spawning and embryo incubation extend from March through July, juvenile rearing occurs year-round, and juvenile emigration occurs May through September. As discussed above, while relatively minor changes would occur in flows and/or water temperatures during May, June, July and August, during the rest of the year, flows and water temperatures simulated at the lower Feather River confluence and at Freeport under the CEQA Yuba Accord Alternative would generally be equivalent to those under the CEQA No Project Alternative. Additionally, during August under the warmest 25 percent of the cumulative water temperature distribution, would water temperatures under the CEQA Yuba Accord Alternative, relative to those under the CEQA No Project Alternative, be measurably lower 32 percent of the time at the lower Feather River confluence, and measurably lower 8 percent of the time at Freeport. Overall, no changes would occur across any water temperature index value for any green sturgeon life stage in the Sacramento River immediately downstream of the Feather River confluence, or at Freeport. Based on the flow and water temperature modeling results described above, the minor changes that would occur in flows and water temperatures would not be expected to substantially affect these green sturgeon life stages (Appendix F4, 3 vs. 2, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of green sturgeon, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for green sturgeon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-24: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect American shad

American shad adult immigration and spawning extends from April through June. Based on the flow and water temperature modeling results under the CEQA Yuba Accord Alternative relative to the No Project Alternative discussed above, the relatively consistent slightly lower flows and almost equivalent water temperatures during May and June, together with the relatively equivalent flows and water temperatures during April would not be expected to substantially affect American shad adult immigration and spawning. Additionally, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in no increases above or decreases below the 60°F and 70°F index values, both immediately downstream of the Feather River confluence and at Freeport, for the 213 months included in the analysis (Appendix F4, 3 vs. 2, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent level of protection for American shad and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-25: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect striped bass

Striped bass adult spawning, embryo incubation and initial rearing extend from April through June. Based on the flow and water temperature modeling results under the CEQA Yuba Accord Alternative relative to the No Project Alternative discussed above, the slightly lower flows and almost equivalent water temperatures during May and June, together with the relatively equivalent flows and water temperatures during April, would not be expected to substantially affect striped bass adult spawning, embryo incubation and initial rearing. Additionally, the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in no increases above or decreases below the 59°F and 68°F index values, both immediately downstream of the Feather River confluence and at Freeport, for the 213 months included in the analysis (Appendix F4, 3 vs. 2, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent level of protection for striped bass and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.3-26: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail adult spawning, embryo incubation and initial rearing extend from February through May. Over the 72-year simulation period, the frequency with which the Yolo Bypass floodplains would be inundated with Sacramento River water is the same under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative. In the Sacramento River immediately downstream of the lower Feather River confluence, the CEQA Yuba Accord Alternative would provide no additional month during the February through May evaluation period with monthly mean flows greater than 56,000 cfs. These results suggest that the availability of splittail spawning, egg incubation, and initial rearing habitat would be essentially the same under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 883 through 894).

Over the 72-year simulation period, the February through May monthly mean water temperatures in the Sacramento River immediately downstream of the lower Feather River confluence under both the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would always be within the suitable range (i.e., 45°F to 75°F) for splittail spawning (Appendix F4, 3 vs. 2, pgs. 957 through 968).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Yuba Accord Alternative would be expected to provide generally equivalent conditions for Sacramento splittail in the Sacramento River. In conclusion, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for, Sacramento splittail and its habitat, relative to the CEQA No Project Alternative.

10.2.3.3 DELTA REGION

The evaluation of biological impacts on delta fisheries resources and their habitats use parameters established by the USFWS, CDFG, NMFS and others, including X2 locations, Delta outflows and E/I ratios, presented below.

X2 LOCATION

Over the entire 72-year period of simulated X2 location, long-term average X2 locations would range from 0.2 km higher during February to 0.2 km lower during September under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Under the CEQA Yuba Accord Alternative, average X2 location by water year type would range from 0.1 km higher during January, February, and April to 0.4 km lower during September in wet years, 0.1 km higher during December, January, February, and March to 0.1 km lower during October, November, August, and September in above normal years, 0.2 km higher during February and June to 0.1 km lower during October, November, August, and September in below normal years, 0.4 km higher during February to 0.2 km lower during September in dry years, and 0.2 km higher during July to 0.1 km lower during October, November, January, and August in critical years (Appendix F4, 3 vs. 2, pg. 1189).

Cumulative X2 location distributions for the CEQA Yuba Accord Alternative and the CEQA No Project Alternative would generally overlap during each month of the year, indicating that the X2 location under each scenario would be downstream of compliance points in the Delta with nearly equal probabilities. Although rare, monthly mean X2 locations would occasionally change by 1.0 km or more, including the following occasions: (1) one upstream movement (1.0 km) during February and (2) one downstream movement (1.1 km) during September. During these months, there would be no instances when a 1.0 km or more change in X2 location resulted in the movement of X2 past designated compliance points at Roe Island, Chipps Island, or the Confluence (Appendix F4, 3 vs. 2, pgs. 1214 through 1225).

During the delta smelt spawning season when changes in X2 location of 0.5 km or more are used as an impact indicator, which extends from February through June, the CEQA Yuba Accord Alternative would result in changes in monthly mean X2 location of 0.5 km or more, as described below (Appendix F4, 3 vs. 2, pgs. 1190 through 1201).

Over the entire 72-year simulation period during the delta smelt spawning season (February through June), the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would result in a 0.5 km or greater upstream shift while X2 is located between Chipps Island and the Confluence compliance points during 13 out of 360 months included in the analysis, and no downstream shifts during any of the 360 months. These upstream shifts would occur 11 times during February and 2 times during June (Appendix F4, 3 vs. 2, pgs. 1190 through 1201).

DELTA OUTFLOW

Over the entire 72-year period of simulated Delta outflow, long-term average Delta outflow would range from 3 percent higher during August to 1 percent lower during November, December, January, and May under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Under the CEQA Yuba Accord Alternative, average Delta outflow by water year type would range from 5 percent higher during August to 1 percent lower during December in wet years, 2 percent higher during July and August to 2 percent lower during November in above normal years, 2 percent higher during August to 2 percent lower during January and May in below normal years, 2 percent higher during July and August to 4 percent lower during January in dry years, and 2 percent higher during July to 3 percent lower during May in critical years (Appendix F4, 3 vs. 2, pg. 1140).

Over the 72-year period of simulation the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would result in increases in the percentage of Delta outflows of 5 percent or more in 8 out of 864 months included in the analysis, and decreases of 5 percent or more in 32 out of 864 months (Appendix F4, 3 vs.2, pgs. 1141 through 1152).

EXPORT-TO-INFLOW RATIO

Delta E/I ratio limits are built into the CALSIM modeling assumptions and, therefore, would be consistently met under both the CEQA Yuba Accord Alternative and Environmental Baseline during all months of the year. Nevertheless, over the entire 72-year period of simulated E/I ratios, long-term average E/I ratio would range from 1 percent higher during January to 1 percent lower during June under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pg. 1238). Under the CEQA Yuba Accord Alternative, average E/I ratio by water year type would range from 1 percent higher during July to no change during all other months in wet years, no change during all months in above normal years, 1 percent higher during January to no change during all other months in below normal years, 1 percent higher during December, January, and August to 1 percent lower during June in dry years, and 1 percent higher during November, January, and September to 3 percent lower during June in critical years. Over the 72-year period of simulation the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would result in a maximum increase of 5 percent, and a maximum decrease of 6 percent in the E/I ratios during any month included in the analysis. Moreover, increases in the percentage of E/I ratios would exceed 5 percent in only 1 out of 864 months included in the analysis (Appendix F4, 3 vs. 2, pgs. 1239 through 1250).

SALVAGE ESTIMATES

Delta Smelt

The combined overall estimated salvage for delta smelt at the CVP and SWP salvage facilities would decrease by 1.0 percent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. The combined estimated salvage by water year type would change by: (1) 0.1 percent increase during wet years; (2) 0.1 percent increase in above normal years; (3) 0.1 percent decrease during below normal years; (4) 3.0 percent decrease during dry years; and (5)

5.3 percent decrease during critical years, under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pg. 1336). At the CVP salvage facilities the monthly estimated salvage would change by: (1) a decline of 201 juveniles in June during dry water years; and (2) a decline of 362 juveniles in June during critical water years under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. At the SWP salvage facilities the monthly estimated salvage would change by: (1) a decline of 52 juveniles in July during below normal water years; (2) a decline of 31 adults in March and 1,608 juveniles in June during dry water years; and (3) a decline of 1,744 juveniles in June and 128 juveniles in July of critical water years under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Observed reductions in estimated salvage reflect differences in export pumping (and associated delta smelt densities) from either of the facilities (Banks or Jones). For a more-detailed discussion of changes in export pumping, see Chapter 5.

Winter-run Chinook Salmon

The combined overall estimated salvage for winter-run Chinook salmon at the CVP and SWP salvage facilities would not change under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. The combined estimated salvage by water year type would change by: (1) 0.1 percent increase during wet years; (2) no change in above normal years; (3) 0.1 percent increase during below normal years; (4) 0.6 percent decrease percent during dry years; and (5) 0.4 percent increase during critical years, under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pg. 1324).

Spring-run Chinook Salmon

The combined overall estimated salvage for spring-run Chinook salmon at the CVP and SWP salvage facilities would decrease by 0.1 percent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. The combined estimated salvage by water year type would change by: (1) no change during wet years; (2) no change in above normal years; (3) no change during below normal years; (4) 1.3 percent decrease during dry years; and (5) no change during critical years, under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pg. 1324).

Steelhead

The combined overall estimated salvage for steelhead at the CVP and SWP salvage facilities would decrease by 0.1 percent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. The combined estimated salvage by water year type would change by: (1) no change during wet years; (2) no change in above normal years; (3) no change during below normal years; (4) 0.5 percent decrease during dry years; and (5) 0.2 percent increase during critical years, under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pg. 1333).

Striped Bass

The combined overall estimated salvage for striped bass at the CVP and SWP salvage facilities would decrease 1.2 percent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. The combined estimated salvage by water year type would change by: (1) 1.2 percent increase during wet years; (2) 1.0 percent increase in above normal years; (3) 0.5 percent decrease during below normal years; (4) 3.2 percent decrease during dry years; and (5)

10.6 percent decrease during critical years, under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 1334 through 1335).

Impact 10.2.3-27: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect delta smelt

Model results indicate that relatively minor and infrequent changes in the location of X2 would occur in response to implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, as described above. The frequency and magnitude of these changes would not be expected to substantially affect delta smelt habitat.

Changes in monthly mean outflow in the Delta, as well as the E/I ratio, would be relatively infrequent and of minor magnitude under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. In addition, overall delta smelt estimated salvage at the CVP and SWP facilities would decrease by 1.0 percent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated delta smelt salvage, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide a similar level of protection for delta smelt and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 1140, 1189, and 1238).

Impact 10.2.3-28: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect winter-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, would not be expected to substantially affect winter-run Chinook salmon habitat. In addition, overall estimated winter-run Chinook salmon salvage at the CVP and SWP facilities would not change under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated winter-run Chinook salmon salvage, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide a similar level of protection for winter-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 1140, 1189, and 1238).

Impact 10.2.3-29: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect spring-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, would not be expected to substantially affect spring-run Chinook salmon habitat. In addition, overall estimated spring-run Chinook salmon salvage at the CVP and SWP facilities would decrease by 0.1 percent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated spring-run Chinook salmon salvage, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide a similar level of protection for spring-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 1140, 1189, and 1238).

Impact 10.2.3-30: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect steelhead

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, would not be expected to substantially affect steelhead habitat. In addition, overall estimated steelhead salvage at the CVP and SWP facilities would decrease by 0.1 percent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated steelhead salvage, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide a similar level of protection for steelhead and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 1140, 1189, and 1238).

Impact 10.2.3-31: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect striped bass

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, would not be expected to substantially affect striped bass habitat. In addition, overall estimated striped bass salvage at the CVP and SWP facilities would decrease by 1.2 percent under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated striped bass salvage, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide a similar level of protection for striped bass and its habitat, relative to the CEQA No Project Alternative (Appendix F3, 3 vs. 2, pgs. 1140, 1189, and 1238).

Impact 10.2.3-32: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) could affect other Delta fisheries resources

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, as described above under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, would not be expected to substantially affect other Delta fisheries resources habitats. In conclusion, the CEQA Yuba Accord Alternative would not unreasonably affect, and would provide a similar level of protection for, other Delta fisheries resources and their habitats, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 1140, 1189, and 1238).

10.2.3.4 *EXPORT SERVICE AREA*

SAN LUIS RESERVOIR

Impact 10.2.3-33: Decreases in San Luis Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Simulated decreases in the water surface elevation of San Luis Reservoir by more than 6 feet per month would occur one more time during March, and would occur the same number of times from April through June under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Therefore, the CEQA Yuba Accord Alternative would not unreasonably affect San Luis Reservoir warmwater fisheries resources, and would provide an equivalent level of protection, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 1438 through 1449).

Impact 10.2.3-34: Decreases in San Luis Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Long-term average end of month storage volumes under the CEQA Yuba Accord Alternative would not change from April through November relative to the CEQA No Project Alternative. Average end of month storage volumes also would not change from April through November during most water year types, with the exception of dry water year types. During dry water year types, end of month storage volumes would be up to 1 percent lower during May, June, October and November, up to 2 percent lower during July and September, and up to 3 percent lower during August. These relatively minor and infrequent changes in end-of-month reservoir storage under the CEQA Yuba Accord Alternative would not unreasonably affect San Luis Reservoir coldwater fisheries resources, and would provide an equivalent level of protection, relative to the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 1339 and 1376).

10.2.4 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE CEQA MODIFIED FLOW ALTERNATIVE COMPARED TO THE CEQA NO PROJECT ALTERNATIVE

Pursuant to Water Code §1736, the SWRCB is authorized to approve long-term changes in YCWA's permits, allowing the transfer or exchange of water, if the proposed changes:

- Would not result in substantial injury to any legal user of water; and
- Would not unreasonably affect fish, wildlife, or other instream beneficial uses.

This comparison of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, provides an evaluation of the potential effects on fish in the Project Area.

10.2.4.1 YUBA REGION

NEW BULLARDS BAR RESERVOIR

Impact 10.2.4-1: Decreases in New Bullards Bar Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June, with the majority of warmwater fish spawning occurring during the months of April and May. Decreases in the water surface elevation of New Bullards Bar Reservoir by more than 6 feet per month from March through June would occur approximately 15 percent less often under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 75 through 86). Reduction in the frequency of potential nest dewatering events would be expected to result in increased nest success and contribute to self-sustaining warmwater fish populations. Therefore, impacts upon warmwater fisheries that may be present in New Bullards Bar Reservoir from potential changes in water surface elevation under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative may be beneficial.

Impact 10.2.4-2: Decreases in New Bullards Bar Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

The CEQA Modified Flow Alternative would result in long-term average New Bullards Bar Reservoir storage of approximately 822 TAF in April to 579 TAF in November (Appendix F4, 4 vs. 2, pg. 1). This reduction would correspond to a change in water surface elevation from approximately 1,924 feet msl to 1,860 feet msl. Under the CEQA No Project Alternative, the November long-term average storage in New Bullards Bar Reservoir would be approximately 600 TAF with a corresponding elevation of 1,865 feet msl (Appendix F4, 4 vs. 2, pg. 50).

Anticipated reductions in reservoir storage associated with the CEQA Modified Flow Alternative would not be expected to adversely impact the New Bullards Bar Reservoir's coldwater fisheries because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample coldwater pool reserves, and throughout the period of operations of New Bullards Bar Reservoir (1969 through present), which encompasses the most extreme critically dry year on record, the coldwater pool in New Bullards Bar Reservoir has not been depleted. Therefore, potential reductions in coldwater pool storage would not be expected to adversely affect New Bullards Bar Reservoir's coldwater fisheries because: (1) coldwater habitat would remain available in the reservoir during all months of the CEQA Modified Flow Alternative; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fish. In conclusion, the CEQA Modified Flow Alternative would not unreasonably affect New Bullards Bar Reservoir coldwater fisheries resources, and would provide an equivalent or higher level of protection, relative to the CEQA No Project Alternative.

Lower Yuba River

The following sections describe and discuss flow and water temperature differences between the CEQA Modified Flow Alternative and the CEQA No Project Alternative, and potential effects on fisheries and aquatic resources in the lower Yuba River.

Impact 10.2.4-3: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The adult immigration and holding life stage primarily extends from March through October. Evaluation of flows at Marysville occurring under the CEQA Modified Flow Alternative and the CEQA No Project Alternative indicates that both alternatives would provide adequate flows for adult spring-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam (Appendix F4, 4 vs. 2, pg. 272). Also, under the CEQA Modified Flow Alternative and the CEQA No Project Alternative, flows in the lower Yuba River throughout the upstream migration period generally would remain within the range sufficient to allow adequate passage of adult spring-run Chinook salmon through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville would result in the same number of occurrences (4 for the 576 months included in the analysis) during which flows at the Daguerre Point Dam fish ladders would exceed 10,000 cfs under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 273 through 284). Finally, under the CEQA Modified Flow Alternative and the CEQA No Project Alternative, stages at Smartville throughout the adult holding period would remain similar. Overall, examination of monthly mean stage simulated at Smartville would result in 10 decreases of one foot or more (for the 576 months included in the analysis) under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 162 through 173). These relatively infrequent and minor changes in stage would not affect adult spring-run Chinook salmon holding habitat conditions, particularly due to the deep nature of the pools in the Narrows Reach below Englebright Dam.

During the March through October adult immigration and holding life stage, water temperatures at Smartville, under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative, generally would remain at or below 58°F, which is below the lowest water temperature index value (60°F), and therefore would remain suitable, for this life stage (Appendix F4, 4 vs. 2, pg. 174).

Simulated water temperatures at Daguerre Point Dam under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative generally would not exceed 60°F over the entire cumulative water temperature distributions from March through August, and during October. However, during September under the CEQA Modified Flow Alternative and the CEQA No Project Alternative, water temperatures would exceed 60°F with about a 40 percent probability. During September under relatively warm water temperature conditions, water temperatures would be measurably higher, and therefore less suitable, about 50 percent of the time. Overall, during the entire March through October adult immigration and holding period at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 60°F index value, no changes at the 64°F and 68°F index values (Appendix G, 4 vs. 2, pgs. G-52 and G-54).

In addition, while the presence of spring-run Chinook salmon below Daguerre Point Dam during the immigration and holding life stage is believed to be transitory, the cumulative water temperature distribution under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, indicate that generally equivalent water temperatures as far downstream as Marysville during March and April, measurably warmer water temperatures frequently occurring during relatively warm water temperature conditions during May and June, and frequent and substantially lower water temperatures from July through October. Specifically, during the warmest months of July and August, water temperatures under the CEQA Yuba Accord Alternative would be substantially lower (generally about 1 – 3°F) and therefore more suitable, over nearly the entire cumulative water temperature distributions. Overall, during the March through October adult immigration and holding life stage at Marysville, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 34 decreases below the 60°F index value, 5 decreases below the 64°F index value, and 4 increases above the 68°F index value (Appendix F4, 4 vs. 2, pgs. 371 through 382).

Spring-run Chinook salmon spawning reportedly occurs above Daguerre Point Dam from September through November. During these months, the annual spawning habitat availability under the CEQA Modified Flow Alternative would be slightly higher than under the CEQA No Project Alternative (long-term average of 90.1 percent versus 89.1 percent of the maximum WUA) (Appendix F4, 4 vs. 2, pg. 395). The CEQA Modified Flow Alternative would achieve over 90 percent of maximum WUA with about a 71 percent probability, while the CEQA No Project Alternative would achieve over 90 percent of maximum WUA with about a 67 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 4 vs. 2, pg. 399).

The spring-run Chinook salmon spawning habitat analysis also emphasized the month of September, because this is the only month during the spring-run Chinook salmon spawning period that is assumed to not temporally overlap with fall-run Chinook salmon spawning (CDFG 2000). For September, spawning habitat availability, expressed as percent maximum WUA, under the CEQA Modified Flow Alternative would be slightly lower under the CEQA No Project Alternative (long-term average of 88.5 percent versus 90.3 percent of maximum WUA) (Appendix F4, 4 vs. 2, pg. 395). Overall, for the month of September, the CEQA Modified Flow Alternative would achieve over 90 percent of maximum WUA with about a 58 percent probability, while the CEQA No Project Alternative would achieve over 90 percent of maximum WUA with about a 65 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 4 vs. 2, pg. 397).

Water temperatures at Smartville during the September through November spawning period generally would not exceed 56°F, and therefore remain suitable for this life stage (Appendix F4, 4 vs. 2, pgs. 175 through 186). Simulated water temperatures at Daguerre Point Dam during November would not exceed 56°F (Appendix F4, 4 vs. 2, pgs. 224 through 235). During September, simulated water temperatures at Daguerre Point Dam under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would exceed 56°F over the entire cumulative water temperature distributions. During relatively warm water temperature conditions, water temperatures under the CEQA Modified Flow Alternative would be measurably higher than the CEQA No Project Alternative with about a 50 percent probability during September, and therefore would be less suitable for spawning. During October, simulated water temperatures at Daguerre Point Dam under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would exceed 56°F with slightly more than a 90 percent probability. However, during October, simulated water temperatures at Daguerre Point Dam under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would be essentially equivalent over nearly the entire cumulative water temperature distributions (Appendix F4, 4 vs. 2, pgs. 245 through 259). Overall, during the entire September through November spawning period, at Daguerre Point Dam the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 decrease below the 58°F index value, 3 decreases below the 60°F index value, and 3 decreases below the 62°F index value (Appendix G, 4 vs. 2, pgs. G-52 through G-54).

The embryo incubation life stage for spring-run Chinook salmon in the lower Yuba River generally occurs between September and March. As indicated above for the spawning life stage, during relatively warm water temperature conditions (when water temperatures would already exceed 60°F, and represent stressful embryonic incubation water temperatures) at Daguerre Point Dam, water temperatures would be measurably higher with about a 50 percent probability during September, and therefore would be less suitable for spring-run Chinook salmon embryo incubation. During October, simulated water temperatures at Daguerre Point Dam would be essentially equivalent over nearly the entire cumulative water temperature distributions. Between November and March, water temperatures generally would not exceed 53°F, would not approach the lowest water temperature index value (56°F), and therefore would remain suitable at Daguerre Point Dam under either the CEQA Modified Flow Alternative or the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 248 through 259).

Spring-run Chinook salmon juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to spring-run Chinook salmon juveniles.

Water temperatures would be higher and therefore less suitable, specifically during about 15 percent of the warmest (when water temperatures exceed 61°F) water temperature conditions at Daguerre Point Dam during September. Simulated water temperature conditions at Marysville would generally be substantially lower, and therefore more suitable, under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative during the over-summer rearing period. At Marysville during the warmest months of July and August, water temperatures under the CEQA Modified Flow Alternative would be consistently and substantially lower (generally about 0.5 – 3°F) and therefore more suitable, over nearly the entire cumulative water temperature distributions (Appendix F4, 4 vs. 2, pgs. 248 through 259 and 371 through 382).

Overall, during the year-round juvenile rearing life stage at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 60°F index value, 1 decrease below the 63°F index value, 1 increase above the 65°F index value, and no change at the 68°F, 70°F or 75°F index values. Overall, at Marysville, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 36 decreases below the 60°F index value, 14 decreases below the 63°F index value, 12 increases above the 65°F index value, 4 increases above the 68°F index value, 2 increases above the 70°F index value, and 1 increase above the 75°F index value (Appendix G, 4 vs. 2, pgs. G-52 through G-54).

The spring-run Chinook salmon smolt emigration period is believed to extend from November through June, although based on CDFG's run-specific determinations, the vast majority (about 94 percent) of spring-run Chinook salmon were captured as post-emergent fry during November and December, with a relatively small percentage (nearly 6 percent) of individuals remaining in the lower Yuba River and captured as YOY from January through March. Only 0.6 percent of the juvenile Chinook salmon identified as spring-run was captured during April, 0.1 percent during May, and none were captured during June. In general, flows during the early portion (November and December) of the smolt emigration period under the CEQA Modified Flow Alternative would be measurably lower at intermediate to high flow conditions, and would be measurably higher than flows under the CEQA No Project Alternative during low flow conditions. Flow reductions at the intermediate to high flow levels would not be expected to substantively affect spring-run Chinook salmon smolt emigration habitat conditions, whereas the measurably higher flows during low flow conditions may facilitate smolt emigration. During January, measurable flow decreases would occur at intermediate flow levels. During winter (February and March), flows under the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be generally similar. During April, May and June, measurable and substantial flow decreases would occur under relatively low to intermediate flow conditions. In fact, under low flow conditions (lowest 25 percent of the flows), decreases of ten percent or more would almost always occur during each of the months of April, May and June at both Smartville and at Marysville (Appendix F4, 4 vs. 2, pgs. 125 through 136 and 297 through 308).

During the November through June smolt emigration life stage, water temperatures at Smartville under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would remain below 60°F, and therefore would remain suitable for this life stage (Appendix F4, 4 vs. 2, pgs. 175 through 186 and 199 through 210).

Simulated water temperatures at Daguerre Point Dam under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would remain below 60°F over the entire cumulative water temperature distributions from November through May. Water temperatures would remain below 60°F during June with about a 90 percent probability under the CEQA Modified Flow Alternative and a 97 percent probability under the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 248 through 259). Overall, during the entire November through June smolt emigration period at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 6 increases above the 60°F index value, and no changes at the 63°F, 68°F and 70°F index values (Appendix G, 4 vs. 2, pgs. G-52 through G-54).

Simulated water temperature conditions at Marysville during the spring-run Chinook salmon smolt emigration period would remain below the lowest water temperature index value of 60°F, and therefore would remain suitable, from November through April under the CEQA Modified Flow Alternative. Water temperatures would exceed 60°F with about a 25 percent probability during May under the CEQA Modified Flow Alternative, but with about a 10 percent probability during the CEQA No Project Alternative. During May under relatively warm water temperature conditions, when water temperatures exceed 60°F, water temperatures under the CEQA Modified Flow Alternative would be higher 100 percent of the time, with temperatures increasing from 2°F to more than 4°F, relative to the CEQA No Project Alternative. During June at Marysville under relatively warm water temperature conditions, when water temperatures exceed 63°F, water temperatures under the CEQA Modified Flow Alternative would be higher 100 percent of the time, with temperatures increasing from 2°F to nearly 5°F, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, 371 through 382). Overall at Marysville, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, would result in 12 increases above the 60°F index value, 11 increases above the 63°F index value, 1 increase above the 68°F index value, and no changes at the 70°F index value (Appendix G, 4 vs. 2, pgs. G-52 through G-54).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent or less suitable adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) similar holding habitat conditions above Daguerre Point Dam; (4) measurably higher, and therefore less suitable, water temperatures during about 15 percent of the warmest water temperature conditions during September at Daguerre Point Dam; and (5) frequently warmer and therefore less suitable water temperatures during the 25 percent warmest water temperature conditions at Marysville during May and June
- Generally equivalent or less suitable spawning conditions due to slightly higher spawning habitat availability during the entire September through November adult spawning period, but slightly lower spawning habitat availability during September separately as a temporally distinct month; and higher and therefore less suitable water temperatures, specifically during about 15 percent of the warmest (when water temperatures exceed 61°F) water temperature conditions at Daguerre Point Dam during September
- Less suitable embryo incubation conditions due to higher, and therefore less suitable water temperatures, specifically during about 15 percent of the warmest (when water temperatures exceed 61°F) water temperature conditions at Daguerre Point Dam during September
- Generally equivalent or improved over-summer juvenile rearing conditions, due to higher, and therefore less suitable water temperatures, specifically during about 15 percent of the warmest (when water temperatures exceed 61°F) water temperature conditions at Daguerre Point Dam during September, and consistently and substantially lower (generally about 0.5 – 3°F), and therefore more suitable, water temperatures at Marysville during July and August
- Generally equivalent or less suitable smolt emigration conditions due to: (1) lower flows at intermediate to high flow levels from November through January, and similar flows during February and March; (2) during April, May and June under low flow conditions (lowest 25 percent of the flows), decreases of ten percent or more would almost always occur at both Smartville and at Marysville, although few (less than 1 percent) spring-run Chinook salmon juveniles have been captured during this portion of the emigration season

In conclusion, in consideration of generally equivalent or less suitable conditions for most life stages of spring-run Chinook salmon, the CEQA Modified Flow Alternative may unreasonably affect, and may not provide an equivalent level of protection for, spring-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-4: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The adult immigration and holding life stage for fall-run Chinook salmon in the lower Yuba River primarily extends from August through November. Evaluation of flows at Marysville occurring under the CEQA Modified Flow Alternative and the CEQA No Project Alternative indicate that both alternatives would provide adequate flows for adult fall-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam. Also, under the CEQA Modified Flow Alternative and the CEQA No Project Alternative, flows in the lower Yuba River throughout the upstream migration period would remain within the range sufficient to allow adequate passage of adult fall-run Chinook salmon through the Daguerre Point Dam fish ladders. Simulated flows at Marysville would be higher by ten percent or more nearly 90 percent of the time during August. During September at Marysville, measurable flow increases would occur nearly 65 percent of the time, at intermediate to high flow levels, although under relatively low flow conditions, measurable decreases would occur 100 percent of the time and flow decreases of ten percent or more would occur about 60 percent of the time. During October at Marysville, measurable flow increases would occur about 65 percent of the time, primarily at intermediate to high flow levels, and would be generally equivalent the remainder of the time. During November at Marysville, measurable flow increases would occur at intermediate to low flow levels, and measurable flow decreases would occur at high flow levels. Similar flow patterns are observed at Smartville (Appendix F4, 4 vs. 2, pgs. 125 through 136 and 297 through 308).

During the August through November adult immigration and holding life stage, water temperatures at Smartville, under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative, generally would remain at or below 58°F, which is below the lowest water temperature index value (60°F), and therefore would remain suitable, for this life stage (Appendix F4, 4 vs. 2, pgs. 175 through 186).

During the August through November adult immigration and holding life stage, simulated water temperatures at Daguerre Point Dam under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative generally would not exceed 60°F, and therefore would remain suitable, over the entire cumulative water temperature distributions during August, October and November. Water temperatures at Daguerre Point Dam during September would exceed 60°F with about a 40 percent probability under both alternatives. However, during September under relatively warm water temperature conditions, water temperatures under the CEQA Modified Flow Alternative would be measurably higher, and therefore less suitable, than the CEQA No Project Alternative with about a 50 percent probability. Overall, during the entire August through November adult immigration and holding period at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 4 decreases below the 60°F index value, and no changes at the 64°F or 68°F index values (Appendix F4, 4 vs. 2, pgs. 248 through 259).

Relative to the CEQA No Project Alternative, monthly mean water temperatures at Marysville during the adult immigration and holding life stage under the CEQA Modified Flow Alternative would be measurably lower and therefore more suitable with about a 90 percent probability during August. During September at Marysville, water temperatures would be essentially equivalent about 50 percent of the time, measurably cooler about 30 percent of the time, and measurably warmer about 20 percent of the time. However, all of the measurable increases (from about 0.5°F to more than 5°F) in water temperature would occur during relatively warm water temperature conditions, when water temperatures already exceed 65°F. Overall at Marysville, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, would result in 32 decreases below the 60°F index value, 7 decreases below the 64°F index value, and 3 increases above the 68°F index value (Appendix F4, 4 vs. 2, pgs. 371 through 382).

Fall-run Chinook salmon spawning occurs in the lower Yuba River from October through December, and may extend into January. During these months, the annual spawning habitat availability under the CEQA Modified Flow Alternative would be higher than under the CEQA No Project Alternative (long-term average of 89.4 percent versus 86.8 percent of the maximum

WUA) (Appendix F4, 4 vs. 2, pg. 400). The CEQA Modified Flow Alternative would achieve over 90 percent of maximum WUA with a 72 percent probability, while the CEQA No Project Alternative would achieve over 90 percent of maximum WUA with a 63 percent probability. Overall, increases of 10 percent or more in spawning habitat availability would occur over about 9.7 percent (7 for the 72 years) of the cumulative WUA distributions (Appendix F4, 4 vs. 2, pg. 402).

Water temperatures at Smartville during the October through December adult spawning period would not exceed 56°F, which is the lowest water temperature index value for this life stage (Appendix F4, 4 vs. 2, pgs. 199 through 210). Simulated water temperatures at Daguerre Point Dam and Marysville during November and December would not exceed 56°F, and therefore would remain suitable for adult spawning. During October at Daguerre Point Dam, water temperatures would be essentially equivalent about 97 percent of the time, and would be measurably lower about 2 percent of the time, during the two warmest years. During October at Marysville, water temperatures would exceed 56°F about 95 percent of the time under both alternatives, essentially equivalent about 90 percent of the time, and measurably lower about 10 percent of the time, including the two warmest years. Overall, the CEQA Modified Flow Alternative would result in no changes at the 56°F or 58°F index values, 1 decrease below the 60°F index value, and 1 decrease below the 62°F index value at Daguerre Point Dam, and no changes at the 56°F index value, 1 decrease below the 58°F index value, 1 decrease below the 60°F index value, and 1 decrease below the 62°F index value at Marysville (Appendix F4, 4 vs. 2, pgs. 248 through 259 and 371 through 382).

The embryo incubation period for fall-run Chinook salmon extends from October through March. In addition to the trends described above, between January and March, water temperatures would not exceed 54°F, would not approach the lowest water temperature index value (56°F), and therefore would remain suitable, at Daguerre Point Dam or Marysville under either the CEQA Modified Flow Alternative or the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 245 through 259 and 371 through 382).

Juvenile fall-run Chinook salmon rear in and emigrate from the lower Yuba River between December and June, although based on CDFG's run-specific determinations, the majority (about 81 percent) of fall-run Chinook salmon are captured moving downstream from December through March, with decreasing numbers captured during April (about 9 percent), May (about 7 percent), and June (about 3 percent). The discussion of flow and water temperature changes provided for spring-run Chinook salmon smolt emigration (see above) encompasses the entire fall-run Chinook salmon juvenile rearing and outmigration time period. As described above, during January measurable flow decreases would occur at intermediate flow levels. During winter (February and March), flows under the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be generally similar. During April, May and June, measurable and substantial flow decreases would occur under relatively low to intermediate flow conditions. In fact, under low flow conditions (lowest 25 percent of the flows), decreases of ten percent or more would almost always occur during each of the months of April, May and June at both Smartville and at Marysville (Appendix G, 4 vs. 2, pgs. G-56 through G-57).

As described in Section 10.2.3, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, a temporal shift (lower flows during approximately the lowest 40 percent of flow conditions in May and June, accompanied by higher flows during about the lowest 35 percent of flow conditions during April) in flows was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes, associated with the timing of juvenile Chinook salmon emigration. This flow pattern was designed to facilitate the emigration of juvenile Chinook salmon when most of them are emigrating, and before warm water temperatures occur during late spring in drier water years in the lower portion of the lower Yuba River, the Feather River, and the Sacramento River.

By contrast to the CEQA Yuba Accord Alternative compared to the CEQA No Project Alternative, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would not provide increased flows under low flow conditions during April, and therefore is not consistent with the intentional design to mimic Yuba River unimpaired springtime flow patterns to facilitate outmigration during drier water years. In addition, by contrast to the discussion of spring-run Chinook salmon smolt emigration (described above), nearly 20 percent of juvenile fall-run Chinook salmon outmigrants have been captured during April, May and June.

Overall, during the entire December through June juvenile rearing and outmigration period at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 6 increases above the 60°F index value, and no changes at the 63°F, 65°F, 68°F and 70°F index values (Appendix F4, 4 vs. 2, pgs. 248 through 259). Overall at Marysville, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, would result in 12 increases above the 60°F index value, 11 increases above the 63°F index value, 16 increases above the 65°F index value, 1 increase above the 68°F index value, and no changes at the 70°F or 75°F index values (Appendix F4, 4 vs. 2, pgs. 371 through 382 and Appendix G, 4 vs. 2, pgs. G-56 through G-57).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent or less suitable adult immigration and holding conditions because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; and (3) measurably higher, and therefore less suitable, water temperatures during about 15 percent of the warmest (when water temperatures exceed 61°F) water temperature conditions during September at Daguerre Point Dam; (4) consistently and substantially lower (generally about 0.5 – 3°F), and therefore more suitable, water temperatures at Marysville during August, but measurable increases (from about 0.5°F to more than 5°F) in water temperatures during about 25 percent of the warmest water temperature conditions during September, when water temperatures already exceed 65°F

- Generally equivalent or improved spawning conditions due to: higher spawning habitat availability, with increases of 10 percent or more in spawning habitat availability occurring 9.7 percent (7 of the 72 years) of the time during the October through December adult spawning period; and slightly lower but infrequent (about 10 percent of the time) water temperatures during October at Marysville

- Generally equivalent embryo incubation conditions due to generally similar water temperatures throughout this life stage

- Less suitable juvenile rearing and outmigration conditions due to: (1) lower flows at intermediate to high flow levels during December and January, and similar flows during February and March; (2) during April, May and June under low flow conditions (lowest 25 percent of the flows), decreases of ten percent or more would almost always occur at both Smartville and at Marysville, which is inconsistent with Yuba River unimpaired springtime flow patterns and the facilitation of outmigration during drier water years, and may affect up to nearly 20 percent of juvenile fall-run Chinook salmon outmigrants; and (3) higher water temperatures (2°F to nearly 5°F) during May and June during the warmest 25 percent of simulated water temperature conditions

In conclusion, in particular consideration of: measurably higher water temperatures at Daguerre Point Dam during September under relatively warm water temperature conditions (generally ≥ 61°F), and higher water temperatures during the warmest 25 percent of water temperature conditions (generally ≥ 65°F) during September at Marysville during the adult immigration and holding life stage; and reduced flows during the lowest 25 percent of flow conditions during April, May and June, with increased water temperatures during May and June under the warmest 25 percent of simulated water temperature conditions during the juvenile rearing and outmigration life stage, the CEQA Modified Flow Alternative may unreasonably affect, and may not provide an equivalent level of protection for, fall-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-5: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the lower Yuba River extends from August through March. Evaluation of flows at Marysville occurring under the CEQA Modified Flow Alternative and the CEQA No Project Alternative indicate that both alternatives would provide adequate flows for adult steelhead upstream critical riffle passage below Daguerre Point Dam. Also, under the CEQA Modified Flow Alternative and the CEQA No Project Alternative, flows in the lower Yuba River throughout the upstream migration period would generally remain within the range sufficient to allow adequate passage of adult steelhead through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville would not result in a change in the number of occurrences during which flows at the Daguerre Point Dam fish ladders exceed 10,000 cfs under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (14 for the 576 months included in the analysis) (Appendix F4, 4 vs. 2, pgs. 273 through 284).

Simulated flows at Smartville and Marysville exhibit similar trends over the August through March adult immigration and holding life stage. During August, flows would be measurably higher 85 and 90 percent of the time, with higher flows of ten percent or more occurring nearly 70 and 90 percent of the time at Smartville and Marysville, respectively. During September, measurable flow increases would occur nearly 65 percent of the time at intermediate to high flow levels, although under relatively low flow conditions measurable decreases would occur 60 to 100 percent of the time and flow decreases of ten percent or more would occur about 45 and 60 percent of the time at Smartville and Marysville, respectively. During October at Smartville, measurable flow increases would occur approximately 60 percent of the time at intermediate to high flow levels, and under low flow conditions when measurable flow increases occur nearly 70 percent of the time. During October at Marysville, measurable flow increases would occur about 65 percent of the time, primarily at intermediate to high flow levels, and would be generally equivalent the remainder of the time. During November, measurable flow increases would occur at intermediate to low flow levels, and measurable flow decreases would occur at high flow levels. In general, flows during December under the CEQA Modified Flow Alternative would be measurably lower at intermediate to high flow conditions, and would be measurably higher than flows under the CEQA No Project Alternative during low flow conditions. Flow reductions at the intermediate to high flow levels would not be expected to substantively affect steelhead adult immigration and holding habitat conditions. During January, measurable flow decreases would occur at intermediate flow levels. During winter (February and March), flows under the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be generally similar (Appendix F4, 4 vs. 2, pgs. 125 through 136 and 297 through 308).

During the August through March adult immigration and holding life stage, water temperatures at Smartville would generally remain cool and suitable for this life stage. From August through October, water temperatures would exceed the 52°F index value but generally remain below the 56°F index value. From November through March, water temperatures at Smartville would generally remain below the 52°F index value (Appendix F4, 4 vs. 2, pgs. 199 through 210).

During the adult immigration and holding life stage, simulated water temperatures during August at Daguerre Point Dam under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be essentially equivalent nearly 20 percent of the time, but would be measurably cooler, and therefore more suitable, nearly 80 percent of the time. Water temperatures at Daguerre Point Dam during September would exceed the 56°F index value 100 percent of the time under both alternatives. However, during September under relatively warm water temperature conditions, water temperatures under the CEQA Modified Flow Alternative would be measurably higher, and therefore less suitable, than the CEQA No Project Alternative with about a 50 percent probability. During October, water temperatures would exceed the 52°F index value but generally would remain below the 56°F index value. During November through March, water temperatures would generally remain below 52°F, and therefore would remain suitable, for this life stage (Appendix F4, 4 vs. 2, pgs. 248 through 259).

At Marysville during August of the adult immigration and holding life stage, water temperatures under the CEQA Modified Flow Alternative would be consistently and substantially lower (generally about 0.5 – 3°F) and therefore more suitable, over nearly the entire cumulative water temperature distributions. During September at Marysville, water temperatures would be essentially equivalent about 50 percent of the time, measurably cooler about 30 percent of the time, and measurably warmer about 20 percent of the time - all of the measurable increases (from about 0.5°F to more than 5°F) would occur during relatively warm water temperature conditions, when water temperatures already exceed 65°F. During October at Marysville, water temperatures would exceed 56°F about 95 percent of the time under both alternatives, would be essentially equivalent about 90 percent of the time, and would be measurably lower about 10 percent of the time, including the two warmest years. During November and March, water temperatures would remain below 52°F nearly 50 percent of the time, and would generally remain below 54°F. Simulated water temperatures at Marysville from December through February would not exceed 52°F, and therefore would remain suitable for adult immigration and holding (Appendix F4, 4 vs. 2, pgs. 371 through 382).

Overall, during the adult immigration and holding life stage at Smartville, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 decrease below the 52°F index value, 2 decreases below the 56°F index value, and no changes at the 70°F index value. At Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 3 decreases below the 52°F index value, 8 decreases below the 56°F index value, and no change at the 70°F index value. At Marysville, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 8 increases above the 52°F index value, and 1 decrease below the 56°F index value, and 2 increases above the 70°F index value (Appendix F4, 4 vs. 2, pgs. 248 through 259 and 371 through 382).

The steelhead spawning season generally extends from January through April, primarily occurring in reaches upstream of Daguerre Point Dam. During these months, the annual spawning habitat availability under the CEQA Modified Flow Alternative would be higher than under the CEQA No Project Alternative (long-term average of 38.0 percent versus 35.6 percent of the maximum WUA) (Appendix F4, 4 vs. 2, pg. 403). The CEQA Modified Flow Alternative would achieve over 50 percent of maximum WUA with about a 35 percent probability, while the CEQA No Project Alternative would achieve over 50 percent of maximum WUA with about a 30 percent probability. Overall, increases of 10 percent or more in spawning habitat availability would occur over about 9.7 percent (7 for the 72 years) of the cumulative WUA distributions (Appendix F4, 4 vs. 2, pg. 405).

From January through April, water temperatures at Smartville would not exceed 52°F, which is the lowest water temperature index value for this life stage, and therefore would remain suitable for adult spawning. During January and February, water temperatures at Daguerre Point Dam also would not exceed 52°F. During March, water temperatures at Daguerre Point Dam under the CEQA Modified Flow Alternative would be essentially equivalent to water temperatures under the CEQA No Project Alternative, and would exceed 52°F with about a 25 percent probability, yet would remain below 53°F. During April, water temperatures at Daguerre Point Dam under the CEQA Modified Flow Alternative would be essentially equivalent to the water temperatures under the CEQA No Project Alternative over 90 percent of the cumulative water temperature distributions, and would be measurably higher about 10 percent of the time (which occurs during relatively warm - about 55°F to 56°F - water temperature conditions). Overall, during the adult spawning life stage, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would not result in any index value crossings at Smartville or at Daguerre Point Dam (Appendix F4, 4 vs. 2, pgs. 199 through 210 and 248 through 259).

The embryo incubation period for steelhead in the lower Yuba River general overlaps with the spawning period, but extends into May. During May, water temperatures at Smartville under the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be essentially equivalent over approximately 90 percent of the cumulative water temperature distributions, and would remain below 54°F. Under relatively warm (about 52.5 to 54°F) water temperature conditions, slight but measurable increases in water temperature would occur about 36 percent of the time under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. During May, water temperatures at Daguerre Point Dam under the CEQA Modified Flow Alternative would be essentially equivalent to the water temperatures under the CEQA No Project Alternative over approximately 75 percent of the cumulative water temperature distribution, and would be measurably higher with about a 25 percent probability. All of the measurable water temperature increases would occur during relatively warm water temperature conditions, when water temperatures range from about 56.5°F to more than 59°F, and therefore may result in less suitable embryo incubation conditions (Appendix F4, 4 vs. 2, pgs. 199 through 210 and 248 through 259).

Overall, during the embryo incubation life stage at Smartville, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative results in 5 increases above the 52°F index value, and no changes at the 54°F, 57°F, or 60°F index values. At Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative results in no changes at the 52°F or 54°F index values, 8 increases above the 57°F index value (all of which occur during May), and no changes at the 60°F index value (Appendix F4, 4 vs. 2, pgs. 199 through 210 and 248 through 259).

Steelhead juveniles are believed to rear in the lower Yuba River year-round. Simulated water temperature conditions at Daguerre Point Dam, and as far downstream as Marysville would be generally substantially lower, and therefore more suitable, under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative during the over-summer rearing period. At Daguerre Point Dam and Marysville during the warmest months of July and August, water temperatures under the CEQA Modified Flow Alternative would be consistently and substantially lower (generally about 0.5 – 3°F) and therefore more suitable, over nearly the entire cumulative water temperature distributions.

Overall, during the year-round juvenile rearing life stage at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 65°F index value, and no changes at the 68°F, 72°F or 75°F index values. Overall, at Marysville, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 12 increases above the 65°F index value, 4 increases above the 68°F index value, no changes at the 72°F index value, and 1 increase above the 75°F index value (Appendix F4, 4 vs. 2, pgs. 199 through 210, 248 through 259, and 371 through 382).

The steelhead smolt emigration period is believed to extend from October through May. During October at Smartville, measurable flow increases would occur approximately 60 percent of the time at intermediate to high flow levels, and under low flow conditions when measurable flow increases would occur nearly 70 percent of the time. During October at Marysville, measurable flow increases would occur about 65 percent of the time, primarily at intermediate to high flow levels, and would be generally equivalent the remainder of the time. During November, measurable flow increases would occur at intermediate to low flow levels, and measurable flow decreases would occur at high flow levels. In general, flows during December under the CEQA Modified Flow Alternative would be measurably lower at intermediate to high flow conditions, and would be measurably higher than flows under the CEQA No Project Alternative during low flow conditions. Flow reductions at the intermediate to high flow levels would not be expected to substantively affect steelhead adult immigration and holding habitat conditions. During January, measurable flow decreases would occur at intermediate flow levels. During winter (February and March), flows under the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be generally similar. During April and May, under relatively low to intermediate flow conditions, measurable and substantial decreases would occur. In fact, under low flow conditions, decreases of ten percent or more would occur with 100 percent probability for each of the months of April and May at both Smartville and at Marysville (Appendix F4, 4 vs. 2, pgs. 125 through 136 and 297 through 308).

During the October through May smolt emigration life stage, water temperatures at Smartville generally would remain cool and suitable for this life stage. During October at Daguerre Point Dam, water temperatures would remain essentially equivalent between the alternatives. From November through March at Daguerre Point Dam, water temperatures would generally remain below 52°F, and therefore suitable for smolt emigration. During April, water temperatures at Daguerre Point Dam under the CEQA Modified Flow Alternative would be essentially equivalent to the water temperatures under the CEQA No Project Alternative over 90 percent of the cumulative water temperature distributions, and would be measurably higher about 10 percent of the time (which occurs during relatively warm - about 55°F to 56°F - water temperature conditions). During May, measurable water temperature increases would occur during relatively warm water temperature conditions, when water temperatures range from about 56.5°F to more than 59°F (Appendix F4, 4 vs. 2, pgs. 199 through 210 and 248 through 259).

During October at Marysville, water temperatures would almost always exceed 55°F under both alternatives, would be essentially equivalent about 90 percent of the time, and would be measurably lower about 10 percent of the time, including the two warmest years. During November and March, water temperatures would remain below 52°F nearly 50 percent of the time, and would remain below 55°F. Simulated water temperatures at Marysville from December through February would not exceed 52°F, and therefore remain suitable for smolt emigration. During April at Marysville, water temperatures would be essentially equivalent and would remain below 55°F. Water temperatures would almost always exceed 52°F, and would exceed 55°F with about a 75 percent probability during May under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. During May under relatively warm water temperature conditions, when water temperatures exceed 60°F, water temperatures under the CEQA Modified Flow Alternative would be higher 100 percent of the time, with temperatures increasing from 2°F to more than 4°F, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 371 through 382).

Overall, during the smolt emigration life stage at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 3 decreases below the 52°F index value, 2 increases above the 55°F index value, and 1 decrease below the 59°F index value. Overall, at Marysville, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 8 increases above the 52°F index value, 1 decrease below the 55°F index value, and 6 increases above the 59°F index value (Appendix F4, 4 vs. 2, pgs. 248 through 259 and 371 through 382).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) similar holding habitat conditions; and (4) consistently and substantially lower, and therefore more suitable, water temperatures during August, but warmer and therefore less suitable water temperatures during September at Daguerre Point Dam and at Marysville

- Improved spawning conditions due to higher spawning habitat availability, with increases of 10 percent or more in spawning habitat availability occurring about 9.7 percent (7 for the 72 years) of the time, and generally equivalent water temperatures above Daguerre Point Dam during the January through April adult spawning period

- Equivalent water temperature conditions over the entire embryo incubation period at Smartville; generally equivalent conditions at Daguerre Point Dam over the majority of the embryo incubation period, with higher water temperatures during May under relatively warm water temperature conditions (when water temperatures range from about 56.5°F to more than 59°F)

- Improved over-summer juvenile rearing conditions, due to consistently and substantially lower (generally about 0.5 – 3°F), and therefore more suitable, water temperatures at Marysville
- Generally equivalent or less suitable smolt emigration conditions due to generally equivalent flows and water temperatures during the majority of the smolt emigration period (October through March), but lower flows during relatively low flow conditions (i.e., the lowest 25 percent of simulated flow conditions) in April and May, and higher water temperatures during May under relatively warm water temperature conditions (i.e., the warmest 25 percent of simulated water temperature conditions) at Daguerre Point Dam and at Marysville

In conclusion, in consideration of potential effects to all life stages of steelhead, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent level of protection for, steelhead and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-6: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect green sturgeon

Flows during the green sturgeon immigration and holding (February through July) and adult spawning and embryo incubation (March through July) life stage periods would be expected to allow adequate upstream migration and spawning habitat availability, under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Overall, under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, would result in 10 decreases below the 61°F index value for adult immigration and holding, 1 increase above the 68°F index value for adult spawning, and 1 increase above the 68°F index value for embryo incubation (Appendix F4, 4 vs. 2, pgs. 199 through 210 and 371 through 382).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juveniles.

Simulated water temperature conditions at Marysville would generally be substantially lower, and therefore more suitable, under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative during the over-summer rearing period. At Marysville during the warmest months of July and August, water temperatures under the CEQA Modified Flow Alternative would be substantially lower (generally about 1 – 3°F) and therefore potentially more suitable, over nearly the entire cumulative water temperature distributions. Overall, during the year-round juvenile green sturgeon rearing life stage, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 16 increases above the 66°F index value.

The juvenile emigration life stage generally extends from May through September. Similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juvenile emigration. As described in the discussion of the year-round juvenile rearing period, during the warmest months of July and August water temperatures under the CEQA Modified Flow Alternative would be substantially lower, and therefore potentially more suitable, over nearly the entire cumulative water temperature distributions, and overall would result in 16 increases above the 66°F index value during the juvenile emigration life stage (Appendix F4, 4 vs. 2, pgs. 199 through 210 and 371 through 382).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding, adult spawning and embryo incubation conditions, because of corresponding upstream migration and spawning flow-related habitat availabilities, and lower and therefore more suitable water temperatures during adult immigration and holding
- Generally equivalent or improved over-summer rearing and juvenile emigration conditions, due to consistently and substantially lower (generally about 1 – 3°F), and therefore potentially more suitable, water temperatures at Marysville

In conclusion, in consideration of potential effects to all life stages of green sturgeon, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for, green sturgeon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-7: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect American shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Yuba River. Studies conducted on the lower Yuba River suggest that shifting of proportional flows (lower Yuba River flows/lower Feather River flows) may simply re-allocate shad from the Feather River to the lower Yuba River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for American shad attraction into the lower Yuba River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.5 percent lower during April, 1.9 percent lower during May, and 0.6 percent lower during June under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Under the CEQA Modified Flow Alternative, during wet years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.1 percent higher during April, and no changes would occur during May or June. During above normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.1 percent lower during April, and no changes would occur during May or June. During below normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.2 percent lower during April, 0.8 percent lower during May, and 0.2 percent lower during June. During dry years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 2.5 percent lower during April, 8.5 percent lower during May, and 2.2 percent lower during June. During critical years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 4.7 percent lower during April, 21.2 percent lower during May, and 8.3 percent lower during June (Appendix F4, 4 vs. 2, pgs. 100 and 272).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Long-term average proportionate flows would not differ by more than 2 percent during April, May or June. Also, the lower proportionate flows during dry and critical years would not be expected to significantly affect American shad attraction into the lower Yuba River because the reductions during dry years are relatively minor and would not exceed about 10 percent, and the combined probability of occurrence of dry and critical years is less than one-third.

Differences in water temperature between the Feather and lower Yuba rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would result in 12 additional occurrences (for the 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 4 vs. 2, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide changes in proportionate lower Yuba River to lower Feather River flows, and water temperatures within the reported range of suitable spawning temperatures, that would not unreasonably affect American shad and its habitat.

Impact 10.2.4-8: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Yuba River. Striped bass spawning and initial rearing in the lower Yuba River extends from April through June. Proportionate flow changes resulting from implementation of the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Yuba River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Long-term average proportionate flows would not differ by more than 2 percent during April, May or June. Also, the lower proportionate flows during dry and critical years would not be expected to significantly affect striped bass attraction into, spawning, embryo incubation and initial rearing in the lower Yuba River because the reductions during dry years are relatively minor and would not exceed about 10 percent, and the combined probability of occurrence of dry and critical years is less than one-third.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 10 additional occurrences (for the 213 months included in the analysis) when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 4 vs. 2, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide changes in proportionate lower Yuba River to lower Feather River flows, and water temperatures within the reported range of suitable spawning and initial rearing water temperatures, that would not unreasonably affect striped bass and its habitat.

10.2.4.2 CVP/SWP UPSTREAM OF THE DELTA REGION

FEATHER RIVER BASIN

Oroville Reservoir

Impact 10.2.4-9: Decreases in Oroville Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Reductions in simulated end-of-month water surface elevation in Oroville Reservoir by more than six feet would occur the same number of times during March and April, three more times during May, and one fewer time during June under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative. These reductions in water surface elevations would not be anticipated to result in substantial reductions in warmwater fish spawning success, because the results suggest that these potential decreases in water surface elevation would not be expected to occur during more than one month of any spawning season. In addition, a 60 percent nest success rate or greater would be achieved during some months of any annual spawning season, which would be expected to provide sufficient recruitment of individuals into the population over the 72-year simulation period. Therefore, the CEQA Modified Flow Alternative would not unreasonably affect Oroville Reservoir warmwater fisheries resources, and would provide an equivalent level of protection, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 456 through 467).

Impact 10.2.4-10: Decreases in Oroville Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Under the CEQA Modified Flow Alternative, long-term average end of month storage is essentially equivalent from April through November, relative to the CEQA No Project Alternative. Average end of month storage by water year type would be essentially equivalent for all months of the April through November period, for all water year types with the exception of May during critical years. During May in critical years, Oroville Reservoir storage volumes would be approximately one percent lower under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative. Therefore, potential changes in coldwater pool storage would not be expected to affect Oroville Reservoir's coldwater fisheries because: (1) coldwater habitat would remain available in the reservoir during all months of the CEQA Modified Flow Alternative; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fish. In conclusion, the CEQA Modified Flow Alternative would not unreasonably affect Oroville Reservoir coldwater fisheries resources, and would provide an equivalent level of protection, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pg. 406).

Lower Feather River

The following sections describe and discuss flow and water temperature differences between the CEQA Modified Flow Alternative and the CEQA No Project Alternative, and potential effects on fisheries and aquatic resources in the lower Feather River.

Over the entire simulation period for every month of the year, long-term average flows and water temperatures for all water year types, monthly mean flows and water temperatures, and the cumulative flow and water temperature distributions in the Low Flow Channel below the Fish Barrier Dam would be essentially equivalent under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Therefore, evaluations of potential effects in the lower Feather River are restricted to below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River (Appendix F4, 4 vs. 2, pgs. 505 through 517 and 554 through 566).

Impact 10.2.4-11: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The analytical period for adult immigration and holding of spring-run Chinook salmon in the Feather River extends from March through October. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would be essentially equivalent or measurably higher ranging from about 90 percent to 100 percent probability all months of this life stage with the exception of June. During June, flow decreases would occur at intermediate to low flow conditions, but remain above about 1,500 cfs about 90 percent of the distribution, and above 3,000 cfs for about 75 percent of the distribution. Simulated flows below the Thermalito Afterbay Outlet would be higher by ten percent or more with a 2 percent probability in April and about a 20 percent probability during May, and would be lower by ten percent or more 2 percent during March and about 10 percent during June. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 20 percent probability during May. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with about a 5 percent probability in March and a 30 percent probability during June (Appendix F4, 4 vs. 2, pgs. 604 through 615 and 628 through 639).

Simulated flows at the mouth of the Feather River under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would be essentially equivalent or measurably higher ranging from about a 90 percent to 100 percent probability all months of this life stage with the exceptions of April, May and June. From April through June, measurable flow decreases would occur at intermediate to low flow conditions, but would remain above about 3,000 cfs with about a 90 percent probability during April, a 75 percent probability during May, and about a 90 percent probability during June. Simulated flows at the mouth of the Feather River would be higher by ten percent or more with about a 1 percent probability during July, and a 25 percent probability during August. By contrast, flows would be lower by 10 percent or more with about a 15 percent probability in May, about a 20 percent probability during June, a 1 percent probability during July, and a 1 percent probability during August. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 4 percent probability during July and about a 90 percent probability in August. Additionally, during relatively low flow conditions, flows would be lower by ten percent or more about 30 percent during May, about 65 percent during June, and about a 5 percent during July and August (Appendix F4, 4 vs. 2, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be essentially equivalent with at least a 90 percent probability during the March through October adult immigration and holding life stage period. Under both alternatives, water temperatures would always remain below the 60°F index value during March, and would remain below the 60°F index value with about a 90 percent probability during April, with only about a 10 percent probability during May, and would nearly always exceed the 60°F index value from June through September. In fact, water temperatures would exceed the 68°F water temperature index value with about a 70 and 50 percent probability during July and August, respectively (Appendix F4, 4 vs. 2, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River would be generally warmer than at Thermalito Afterbay Outlet during each month of the March through October adult immigration and holding life stage, particularly during the warm summer months of June through September, when water temperatures at the mouth of the Feather River would be frequently 1 – 4°F warmer than at the Thermalito Afterbay Outlet, under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative. At the mouth of the Feather River, water temperatures under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would be generally equivalent during March, April, September and October. During May and June, water temperatures would be measurably warmer at primarily intermediate to warm water temperature conditions. During July and August, water temperatures under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would always exceed the 68°F water temperature index value, although water temperatures under the CEQA Modified Flow Alternative would consistently be about 0.3°F to about 1°F cooler than the CEQA No Project Alternative, when temperatures would be stressful to this species and life stage (Appendix F4, 4 vs. 2, pgs. 825 through 836 and 849 through 860).

Overall, during the entire March through October adult immigration and holding period below the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 increase at the 60°F index value and no changes at the 64°F, or 68°F index values (Appendix F4, 4 vs. 2, pgs. 675 through 689). At the mouth of the Feather River, the CEQA Modified Flow Alternative would result in 1 decrease below the 60°F index value, 1 increase above the 64°F index value, and 3 increases above the 68°F index values (Appendix F4, 4 vs. 2, pgs. 825 through 836).

Because no clear distinction between spring- and fall-run Chinook salmon spawning could be derived from survey data collected in the Feather River, the spawning habitat analysis for potential impacts on the two runs was combined into one expanded spawning season (September through December) that was inclusive of all Chinook salmon spawning in the Feather River. Over the 71-year simulation period, the annual spawning habitat availability long-term average for Chinook salmon spawning in the Feather River under the CEQA Modified Flow Alternative would be nearly identical to that under the CEQA No Project Alternative (long-term average of 85.3 percent versus 85.4 percent of the maximum WUA) (Appendix F4, 4 vs. 2, pg. 873).

The cumulative annual Chinook salmon spawning habitat availabilities under the CEQA Modified Flow Alternative are almost undistinguishable from those under the CEQA No Project

Alternative. Both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would achieve over 90 percent of maximum WUA with nearly a 30 percent probability, and both alternatives would achieve over 80 percent of maximum WUA with about an 85 percent probability. Changes of 10 percent or more in annual spawning habitat availability would not occur (Appendix F4, 4 vs. 2, pg. 875).

Water temperatures below the Thermalito Afterbay Outlet during September, which represents the earliest month of the spawning period, are nearly identical between the CEQA Modified Flow Alternative and the CEQA No Project Alternative, and commonly would exceed water temperatures reported to be suitable for Chinook salmon spawning. For example, under both alternatives, water temperatures below the Thermalito Afterbay Outlet during September would exceed 62°F with about a 90 percent probability. Water temperatures under both alternatives also would be nearly identical during October, November and December. Under both alternatives, during October water temperatures would exceed the reported optimum (56°F) for Chinook salmon spawning with about a 95 percent probability, whereas water temperatures would remain suitable for spawning during November and December (Appendix F4, 4 vs. 2, pgs. 678 through 689 and 702 through 713).

The embryo incubation life stage for Chinook salmon in the Feather River generally extends from September through February. Timing of fry emergence is primarily dependant on water temperature. As indicated above for the spawning life stage, water temperatures below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be nearly identical to those under the CEQA No Project Alternative during the September through December period. During January and February, water temperatures generally would not exceed 53°F, and therefore would not approach the lowest water temperature index value (56°F) below the Thermalito Afterbay Outlet under either the CEQA Modified Flow Alternative or the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 678 through 689 and 702 through 713).

Long-term average early life stage survival estimates would be identical under the CEQA Modified Flow Alternative and the CEQA No Project Alternative (97.7 percent). Early life stage survival estimates would not differ by more than 0.3 percent for any individual year included in the 71-year period of analysis. Substantial reductions in salmon survival over three or more consecutive years are not observed between the CEQA Modified Flow Alternative and the CEQA No Project Alternative. Therefore, the CEQA Modified Flow Alternative would not be anticipated to affect potential future recruitment from a given spawning stock, which may in turn affect the population dynamics of subsequent generations (Appendix F4, 4 vs. 2, pg. 881).

Spring-run Chinook salmon juveniles are commonly reported to rear in their natal streams from 9 to 18 months. Specific habitat-discharge relationships for juvenile Chinook salmon rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to Chinook salmon juveniles. Therefore, for impact assessment purposes, year-round examination of water temperatures is conducted to address potential juvenile spring-run Chinook salmon rearing in the Feather River.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative are nearly identical to those under the CEQA No Project Alternative over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. From November through April, water temperatures would generally remain below 60°F under both alternatives. Water temperatures during May would remain at or below 65°F with nearly a 90 percent probability, whereas during June water temperatures would exceed 65°F with about a 70 percent probability, would always exceed 65°F during July and August, and would exceed 65°F during September with about a 30 percent probability. Water temperatures are considered to be particularly stressful to rearing juvenile Chinook salmon during July and August, when water temperatures would exceed 70°F with about a 25 percent probability. Overall, during the year-round juvenile Chinook salmon rearing life stage below the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 60°F index value, 1 decrease below the 65°F index value, and no changes at the 63°F, 68°F, 70°F, or 75°F index values (Appendix F4, 4 vs. 2, pgs. 678 through 689 and 702 through 713).

Spring-run Chinook salmon smolt emigration reportedly occurs from October through June. Flows below the Thermalito Afterbay Outlet from October through May would be essentially equivalent or higher for at least 90 percent of the cumulative flow distribution during any individual month under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. During June below the Thermalito Afterbay Outlet, measurable flow decreases would occur at intermediate to low flow levels under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, but would remain above 1,500 cfs for about 90 percent of the distribution, and above 3,000 cfs for about 75 percent of the distribution (Appendix F4, 4 vs. 2, pgs. 604 through 615 and 628 through 639).

During the spring-run Chinook salmon smolt emigration life stage, simulated flows below the Thermalito Afterbay Outlet would be higher by ten percent or more under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative with about a 10 percent probability in November, a 3 percent probability in January, a 1 percent probability in March, a 2 percent probability in April, and about a 20 percent probability during May. Flows would be lower by ten percent or more with about a 2 percent probability during March and about a 10 percent probability in June. During low flow conditions, flows would be higher by ten percent or more during May with about a 20 percent probability and would be lower by ten percent or more during March and June with about a 10 percent and 30 percent probability, respectively (Appendix F4, 4 vs. 2, pgs. 776 through 787 and 800 through 811).

Simulated flows at the mouth of the Feather River would be higher by ten percent or more with a 2 percent probability in January, and would be lower by ten percent or more with a 4 percent probability in November, about a 15 percent probability in December and May, a 2 percent probability in January, and about a 20 percent probability in June. During low flow conditions, flows would be higher by ten percent or more during January with about a 10 percent probability and would be lower by ten percent or more during January, May, and June with about 4, 30, and 65 percent probabilities, respectively (Appendix F4, 4 vs. 2, pgs. 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be generally equivalent over the entire cumulative water temperature distributions during the October through June smolt emigration life stage period. Under both alternatives, water temperatures would always remain below the 60°F index value from November through March, would remain below the 60°F index value with nearly a 50 and 90 percent probability during October and April, respectively. Water temperatures would exceed the 60°F index value with about a 90 percent probability during May, and would always exceed 60°F during June under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 678 through 689 and 702 through 713).

With the exception of the winter months of November through February when water temperatures would remain cool (< 56°F), water temperatures at the mouth of the Feather River would be warmer than at Thermalito Afterbay Outlet during the October through June smolt emigration life stage. At the mouth of the Feather River, water temperatures under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would be generally equivalent during October, March, and April. During primarily intermediate to warm water temperature conditions, water temperatures would be measurably warmer during May, which generally occur during “drier” water year types. During June, water temperatures under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would be essentially equivalent for about 80 percent of the cumulative flow distribution and would be measurably warmer for the remaining 20 percent (appendix F4, 4 vs. 2, pgs. 825 through 836).

Overall, during the entire October through June smolt emigration period below the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in one increase at the 60°F index value and no changes at the 63°F, 68°F, or 70°F index values. At the mouth of the Feather River, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would result in 1 decrease below the 60°F index value, no changes at the 63°F index value, 3 increases above the 68°F index value, and 2 increases above the 70°F index value (Appendix F4, 4 vs. 2, pgs. 825 through 836).

The most notable trends in flow and water temperature conditions during the smolt emigration period are: (1) flow reductions primarily occurring at intermediate to low flow conditions during May and June at the mouth of the Feather River; and (2) measurably warmer water temperatures during May and June. This trend may not substantively affect spring-run Chinook salmon smolt emigration because: (1) as discussed above under the lower Yuba River spring-run Chinook salmon smolt emigration discussion, this flow pattern may accommodate the emigration of juvenile spring-run Chinook salmon before warm water temperatures occur during late spring in drier water years in the lower portion of the Feather River; and (2) in the Feather River, data on juvenile Chinook salmon emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run emigration (DWR and Reclamation 1999; Painter *et al.* 1977).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent adult immigration and holding conditions, because of: (1) equivalent or measurably higher flows at Thermalito Afterbay Outlet ranging from 90 percent to 100 percent of the time during all months of this life stage with the exception June; (2) June flows at Thermalito Afterbay Outlet remain above about 1,500 cfs 90 percent of the time, and above 3,000 cfs more than 75 percent of the time; and (3) water temperatures are consistently about 0.3 to about 1°F cooler during July and August at the mouth of the Feather River, when temperatures are most stressful to this species and life stage

- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period, and nearly identical water temperatures below the Thermalito Afterbay Outlet

- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates

- Equivalent over-summer juvenile rearing conditions due to nearly identical water temperatures below the Thermalito Afterbay Outlet
- Generally equivalent smolt emigration conditions due to generally equivalent flow and water temperature conditions with the exception of flow reductions primarily occurring at intermediate to low flow conditions during May and June at the mouth of the Feather River, and measurably warmer water temperatures during May and June. This trend may not substantively affect spring-run Chinook salmon smolt emigration because: (1) as discussed above under the lower Yuba River spring-run Chinook salmon smolt emigration discussion, this flow pattern may accommodate the emigration of juvenile spring-run Chinook salmon before warm water temperatures occur during late spring in drier water years in the lower portion of the Feather River; and (2) in the Feather River, data on juvenile Chinook salmon emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run emigration (DWR and Reclamation 1999; Painter *et al.* 1977).

In conclusion, in consideration of potential effects to all life stages of spring-run Chinook salmon, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent level of protection for, spring-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-12: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The analytical period for adult immigration and holding of fall-run Chinook salmon in the Feather River extends from July through December. The flows under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative during March through October are described in the discussion provided above for spring-run Chinook salmon adult immigration and holding. That discussion concludes that the flows under the CEQA Modified Flow Alternative would provide generally equivalent adult immigration and holding conditions for spring-run Chinook salmon, relative to the CEQA No Project Alternative flows. During November and December, the only months during the fall-run Chinook salmon adult immigration and holding life stage period that do not overlap with the spring-run Chinook salmon adult immigration and holding period, flows at Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be essentially equivalent to or higher than the flows under the CEQA No Project Alternative over 95 percent of the cumulative flow distribution during November and over about 90 percent of the distribution in December (Appendix F4, 4 vs. 2, pgs. 628 through 639). At the mouth of the Feather River, flows under the CEQA Modified Flow Alternative would be essentially equivalent or higher than flows under the CEQA No Project Alternative over about 45 percent of the cumulative flow distribution during November and over about 40 percent in December; flows are lower in November and December at intermediate to high flows (e.g., when flows are greater than about 2,000 cfs). Therefore, flows under the CEQA Modified Flow Alternative would be expected to provide generally equivalent adult immigration and holding conditions for fall-run Chinook salmon, relative to the CEQA No Project Alternative flows (Appendix F4, 4 vs. 2, pgs. 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be essentially equivalent over the entire cumulative water temperature distributions during the July through December adult immigration and holding life stage period. Under both alternatives, water temperatures would nearly always exceed the 60°F index value from July through September, would remain below the 60°F index value with about a 50 percent probability during October, and would always remain below the 60°F index value during November and December. Under both alternatives, water temperatures would exceed the 68°F water temperature index value with about a 70 percent probability, a 50 percent probability, and a 2 percent probability during July, August, and September, respectively (Appendix F4, 4 vs. 2, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River would generally be warmer than at Thermalito Afterbay Outlet during each month of the July through December adult immigration and holding life stage, particularly during the warm summer months of July through September, when water temperatures at the mouth of the Feather River would frequently 1 – 4°F be warmer than at the Thermalito Afterbay Outlet, under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative. At the mouth of the Feather River, during July and August, water temperatures under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would always exceed the 68°F water temperature index value, although water temperatures under the CEQA Modified Flow Alternative would be consistently about 0.3 to about 1°F cooler than the CEQA No Project Alternative, when temperatures would be stressful to this species and life stage. Water temperatures at the mouth of the Feather River under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would nearly always be essentially equivalent from September through December (Appendix F4, 4 vs. 2, pgs. 825 through 836 and 849 through 860).

Overall, during the entire July through December adult immigration and holding period below the Thermalito Afterbay Outlet and at the mouth of the Feather River, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 decrease below the 60°F index value and no changes at the 64°F or 68°F index values.

The adult spawning and embryo incubation life stage periodicities of fall-run Chinook salmon in the Feather River are not distinguished from those of the spring-run; therefore these life stages are not evaluated separately. For evaluation of Chinook salmon spawning and embryo incubation under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, see the discussion provided above under spring-run Chinook salmon.

The analytical period for fall-run Chinook salmon juvenile rearing and outmigration on the Feather River extends from November through June. The flows under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative during October through June are described in detail in the discussion provided above for spring-run Chinook salmon smolt emigration. That discussion suggests that the relative flow differences between the operational alternatives during the October through June period would not be expected to substantially affect spring-run Chinook salmon smolt emigration. Therefore, because the fall-run Chinook salmon juvenile outmigration period (November through June) falls within the spring-run Chinook salmon smolt emigration period (October through June), the flow differences from fall through spring also would not be expected to have substantial effects on fall-run Chinook salmon juvenile outmigration.

Specific habitat-discharge relationships for juvenile Chinook salmon rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, water temperatures may be a primary stressor to rearing Chinook salmon juveniles. Therefore, for impact assessment purposes, an examination of water temperatures during November through June is conducted to address potential impacts to juvenile fall-run Chinook salmon rearing in the Feather River. This examination also applies to juveniles migrating downstream because, the thermal requirements of fall-run Chinook salmon juveniles are equivalent whether the juveniles are rearing or migrating downstream.

Simulated water temperatures under both alternatives would generally be similar for each month of the fall-run Chinook salmon juvenile rearing life stage. From November through April, water temperatures at the Thermalito Afterbay Outlet would generally remain below 60°F under both alternatives. Water temperatures during May would remain at or below 65°F with about a 90 percent probability, whereas during June water temperatures would exceed 65°F with about a 70 percent probability. Overall, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would result in 1 increase at the 60°F index value, 2 decrease below the 65°F index value, and no changes at the 63°F, 68°F, 70°F, and 75°F index values (Appendix F4, 4 vs. 2, pgs. 678 through 689 and 702 through 713).

Simulated water temperatures under both alternatives at the mouth of the Feather River would be generally similar from November through April. During May and June, water temperatures under the CEQA Modified Flow Alternative would be measurably warmer than under the CEQA No Project Alternative at primarily intermediate to warm water temperature conditions. Water temperatures are considered to be particularly stressful to rearing juvenile Chinook salmon during June, when water temperatures would exceed 70°F with about a 50 percent probability under both alternatives (Appendix F4, 4 vs. 2, pgs. 849 through 860). Overall, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would result in no changes at the 60°F index value, 1 increase above the 63°F index value, 3 increases above the 68°F index value, 2 increases above the 70°F index value, and no changes at the 65°F or 75°F index values (Appendix F4, 4 vs. 2, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent or potentially more suitable adult immigration and holding conditions, because of: (1) generally similar flows at Thermalito Afterbay Outlet and at the mouth of the Feather River during most months of this life stage (July through December); and (2) water temperatures are consistently about 0.3 to about 1°F cooler during July and August at the mouth of the Feather River, when temperatures are most stressful to this species and life stage
- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period, and nearly identical water temperatures below the Thermalito Afterbay Outlet
- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates
- Equivalent rearing and outmigration conditions due to: (1) essentially equivalent flows at Thermalito Afterbay Outlet and at the mouth of the Feather River for most months during November through June, which provides similar outmigration conditions; and (2) essentially equivalent water temperatures for juvenile rearing below the Thermalito Afterbay Outlet and at the mouth of the Feather River for most months from November through June

In conclusion, in consideration of potential effects to all life stages of fall-run Chinook salmon, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent level of protection for, fall-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-13: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the Feather River extends from August through April. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would be essentially equivalent or measurably higher ranging from about a 90 percent to 100 percent probability all months of this life stage. Flows also would be generally equivalent during low flow conditions, with flow differences of ten percent or more only occurring in March with about a 10 percent probability (Appendix F4, 4 vs. 2, pgs. 628 through 639 and 604 through 615).

At the mouth of the Feather River, simulated flows under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would be essentially equivalent or measurably higher with a probability ranging from about 70 percent to 98 percent during August through April, except for November, December, and January. During these exceptions, flows would be measurably lower with a probability of about 55 percent; however, the flow reductions primarily occur at intermediate to high flow conditions (e.g., when flows are greater than 2,000 cfs) and therefore would not be expected to substantially affect steelhead adult immigration and holding (Appendix F4, 4 vs. 2, pgs. 776 through 787 and 800 through 811).

In general, the CEQA Modified Flow Alternative would be expected to provide an equivalent or somewhat cooler and therefore more suitable thermal regime for steelhead adult immigration and holding, relative to the CEQA No Project Alternative. For example, water temperatures at Thermalito Afterbay Outlet and at the mouth of the Feather River under both alternatives would be essentially equivalent for at least 95 percent of the cumulative water temperature distribution for each month from August through April. The only exception to this is during August at the mouth of the Feather when water temperatures would be measurably cooler under the CEQA Modified Flow Alternative with about a 95 percent probability, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 702 through 713 and 800 through 811). Overall, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would result in no changes at either the 52°F or 56°F index values and 5 decreases below the 70°F index value (Appendix G, 4 vs. 2, pg. G-78).

The steelhead spawning season in the Feather River generally extends from December through March. During this life stage, the long-term average annual spawning habitat availability would be 55.2 percent of the maximum WUA under the CEQA Modified Flow Alternative and would be 55.4 percent of maximum WUA under the CEQA No Project Alternative. Both alternatives would provide at least 90 percent of the maximum WUA for about 10 percent of the cumulative WUA distribution. The spawning habitat availability under the CEQA Modified Flow Alternative would not differ from that under the CEQA No Project Alternative by more than 4 percent (Appendix F4, 4 vs. 2, pgs. 876 and 878).

From December through March, water temperatures at Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would almost always be essentially equivalent to water temperatures under the CEQA No Project Alternative. During the adult spawning life stage, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would not result in changes at any of the steelhead spawning index values (Appendix F4, 4 vs. 2, pgs. 678 through 689).

The embryo incubation period for steelhead in the Feather River generally overlaps with the spawning period, but extends into May. During April and May, water temperatures at Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be essentially equivalent to the water temperatures under the CEQA No Project Alternative except for measurably warmer water temperatures over about 5 percent of the cumulative water temperature distribution in May. Overall, during the embryo incubation life stage at the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 60°F index value and no changes at the 52°F, 54°F, or 57°F index values (Appendix F4, 4 vs. 2, pgs. 702 through 713).

Steelhead juveniles are believed to rear in the Feather River year-round. Specific habitat-discharge relationships for juvenile rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be nearly identical to those under the CEQA No Project Alternative over the entire cumulative water temperature distributions during each month of the year-round juvenile rearing period. From October through April, water temperatures generally would remain below 60°F under both alternatives. Water temperatures during May would remain at or below 65°F with nearly a 90 percent probability, whereas during June water temperatures would exceed 65°F with about a 70 percent probability, would always exceed 65°F during July and August, and would exceed 65°F with about a 35 percent probability during September. Water temperatures are considered to be particularly stressful to rearing steelhead during July and August, when water temperatures would exceed about 70°F with nearly a 25 percent probability. Overall, during the year-round steelhead rearing life stage below the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 2 decreases below the 65°F index value and no changes at the 68°F, 72°F, or 75°F index values (Appendix F4, 4 vs. 2, pgs. 702 through 713).

The Feather River steelhead smolt emigration analytical period is believed to extend from October through May. The flows under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative during October through June are described in detail in the discussion provided above for spring-run Chinook salmon smolt emigration. That discussion suggests that the relative flow differences between the operational alternatives during the October through June period would not be expected to substantially affect spring-run Chinook salmon smolt emigration; therefore, because the steelhead smolt emigration period (October through May) falls within the spring-run Chinook salmon smolt emigration period (October through June), the flow differences from fall through spring also would not be expected to have substantial effects on steelhead smolt emigration.

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative are generally equivalent over the entire cumulative water temperature distributions during the October through May smolt emigration life stage period. With the exception of the winter months of November through

February when water temperatures would remain cool (< 56°F), water temperatures at the mouth of the Feather River would be warmer than at Thermalito Afterbay Outlet during the October through May smolt emigration life stage. At the mouth of the Feather River, water temperatures under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would be generally equivalent during October, March, and April. During primarily intermediate to warm water temperature conditions, water temperatures would be measurably warmer (by up to 1°F) under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative during May, which would generally correspond to "drier" water year types (Appendix F4, 4 vs. 2, pgs. 678 through 689, 702 through 713, 825 through 836, and 849 through 860).

Overall, during the entire October through May smolt emigration period below the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in no changes at the 52°F, 55°F, and 59°F index values (Appendix F4, 4 vs. 2, pgs. 678 through 689). At the mouth of the Feather River, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would result in no changes at the 52°F or 55°F index values and 1 increase above the 59°F index value (Appendix F4, 4 vs. 2, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding conditions, because of: (1) essentially equivalent or slightly higher flows during this life stage; (2) similar holding habitat conditions; and (3) consistently and substantially cooler water temperatures during July and August at the mouth of the lower Feather River
- Equivalent spawning habitat availability, and essentially equivalent water temperatures at Thermalito Afterbay Outlet during the December through March adult spawning period
- Essentially equivalent water temperatures at Thermalito Afterbay Outlet over nearly the entire embryo incubation period
- Essentially equivalent water temperatures at Thermalito Afterbay Outlet over nearly the entire year-round juvenile rearing period
- Generally equivalent smolt emigration conditions during the majority of the smolt emigration period (October through May), with lower flows during the lowest 40 percent of flows during May, and warmer water temperature conditions during about 35 percent of the warmest water temperature conditions at the mouth of the Feather River, although these conditions may not substantively affect steelhead smolt emigration because this flow pattern may accommodate the emigration of juvenile steelhead before warm water temperatures occur during late spring in drier water years in the lower portion of the Feather River

In conclusion, in consideration of potential effects to all life stages of steelhead, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent level of protection for, steelhead and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-14: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect green sturgeon

The analytical period for green sturgeon adult immigration and holding extends from February through July. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would be essentially equivalent or higher ranging from about a 95 percent to 100 percent probability all months of this life stage with the exception of June. During June, flow decreases would occur at low to intermediate flow conditions, but would remain above about 1,500 cfs about 90 percent of the distribution, and above 3,000 cfs for about 75 percent of the distribution. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative, relative to under the CEQA No Project Alternative would be higher by ten percent or more during this life stage with a 1 percent probability in March, a 2 percent probability in April, and about a 20 percent probability during May. Flows under the CEQA Modified Flow Alternative, relative to under the CEQA No Project Alternative would be lower by ten percent or more 2 percent of the time during March and about 10 percent of the time during June. During relatively low flow conditions, flows would be higher by ten percent or more with about a 20 percent probability during May. Conversely, during relatively low flow conditions, flows would be lower by ten percent or more with about a 10 percent probability in March and about a 30 percent probability during June (Appendix F4, 4 vs. 2, pgs. 628 through 639 and 702 through 713).

This temporal trend in flow changes also occurs at Shanghai Bench and at the mouth of the Feather River, with the exception that flows during low flow conditions in April, May, and June would be generally lower under the CEQA Modified Flow Alternative than under the CEQA No Project Alternative. For example, during low flow conditions at Shanghai Bench, flows would be lower by ten percent or more with about an 8 percent probability during April and about a 65 percent and 70 percent probability during May and June, respectively. Based on the frequency and magnitude of the flow changes observed in the monthly mean flow data, as well as in the data for long-term average flows, average flows by water year type, and flow exceedance, flows during the green sturgeon immigration and holding life stage would be expected to provide similar conditions for upstream migration and holding under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 751 through 762 and 800 through 811).

Because the analytical period for green sturgeon spawning (i.e., March through July) falls within the adult immigration and holding analytical period, flows under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative also would be expected to provide similar conditions for the spawning life stage.

Relative to the CEQA No Project Alternative, water temperatures under the CEQA Modified Flow Alternative would be expected to provide similar conditions during each of the adult immigration and holding, spawning, and embryo incubation life stages. From February through July at Thermalito Afterbay Outlet, water temperatures under both alternatives would be essentially equivalent with a probability of at least 90 percent. At the mouth of the Feather River, water temperatures under both alternatives would be essentially equivalent or measurably cooler with about a 98 percent probability, except for during May and June when water temperatures would be measurably warmer at primarily intermediate to warm conditions (about 35 percent and 20 percent of the cumulative water temperature distributions, respectively) (Appendix F4, 4 vs. 2, pgs. 849 through 860). During the adult immigration and holding life stage at the Thermalito Afterbay Outlet and at the mouth of the Feather River, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would result in

1 increase above the 61°F index value. During the adult spawning and embryo incubation life stages, which are evaluated at the Thermalito Afterbay Outlet, but not at the mouth of the Feather River, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not result in changes at the 68°F index value (Appendix F4, 4 vs. 2, pgs. 678 through 689 and 825 through 836).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Specific habitat-discharge relationships for green sturgeon juvenile rearing have not been developed for the Feather River. Year-round flows below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River have been generally described above under the spring-run Chinook salmon, fall-run Chinook salmon, and steelhead life stage evaluations. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juveniles.

Relative to the CEQA No Project Alternative, water temperatures under the CEQA Modified Flow Alternative would be expected to provide similar conditions during the juvenile rearing life stage. Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be generally equivalent to those under the CEQA No Project Alternative over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. For example, the water temperatures at this location under the alternatives would be essentially equivalent for at least 95 percent of the cumulative water temperature distribution during any given month (Appendix F4, 4 vs. 2, pgs. 702 through 713). Simulated water temperatures at the mouth of the Feather River under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would be generally similar from September through April, slightly warmer during May and June, and cooler during July and August. Overall, during the year-round juvenile green sturgeon rearing life stage, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would result in 2 increases above the 66°F index value (Appendix F4, 4 vs. 2, pgs. 849 through 860).

The analytical period for the juvenile emigration life stage extends from May through September. Trends in flows during this life stage are encompassed in the description above for spring-run Chinook salmon adult immigration and holding. Similar to the green sturgeon juvenile rearing life stage, the available information suggests that physical habitat for green sturgeon juvenile emigration would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juvenile emigration. As described in the discussion for juvenile rearing, the CEQA Modified Flow Alternative would be expected to provide generally similar water temperature conditions year-round.

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent adult immigration and holding, adult spawning and embryo incubation conditions, because of corresponding upstream migration and spawning flow-related habitat availabilities, and suitable water temperatures during adult immigration and holding

- Generally equivalent or improved over-summer juvenile rearing and juvenile emigration conditions, due to consistently and substantially cooler water temperatures during July and August at the mouth of the lower Feather River

In conclusion, in consideration of potential effects to all life stages of green sturgeon, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent level of protection for, green sturgeon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-15: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect American Shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Feather River. As discussed above for lower Yuba River American shad, shifting of proportional flows (lower Feather River flows/Sacramento River flows) may simply re-allocate shad from the Sacramento River to the lower Feather River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for American shad attraction into the lower Feather River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Feather River flow, measured at its mouth, to Sacramento River flow, measured downstream of its confluence with the Feather River, would be 0.1 percent lower during April, 0.3 percent lower during May, and 0.7 percent lower during June under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Under the CEQA Modified Flow Alternative, during wet and above normal years there would be no change in long-term average percentage of lower Feather River flow to Sacramento River flow during April, May and June. During below normal years the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.1 percent higher during April, 0.4 percent lower during May, and 0.3 percent lower during June. During dry years the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.3 percent lower during April, 1.0 percent lower during May, and 1.8 percent lower during June. During critical years the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.3 percent lower during April, 2.8 percent lower during May, and 4.2 percent lower during June (Appendix F4, 4 vs. 2, pgs. 775 and 882).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. The lower proportionate flows, particularly in May and June of dry and critical years, would not be expected to significantly affect American shad attraction into the lower Feather River because the combined probability of occurrence of dry and critical years is less than one-third of the time, and because proportionate flows would be the same in wet and above normal years, and similar in below normal years.

Differences in water temperature between the Sacramento and lower Feather rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage, the CEQA Modified Flow Alternative relative to the CEQA No Project

Alternative would result in 2 additional occurrences (for the 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Feather River mouth (Appendix F4, 4 vs. 2, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide changes in proportionate lower Feather River to Sacramento River flows, and water temperatures within the reported range of suitable spawning temperatures, that would not unreasonably affect American shad and its habitat.

Impact 10.2.4-16: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Feather River. Striped bass spawning and initial rearing in the lower Feather River extends from April through June. Proportionate flow changes resulting from implementation of the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Feather River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. The lower proportionate flows, particularly in May and June of dry and critical years, would not be expected to significantly affect striped bass attraction into, and spawning and initial rearing in the lower Feather River because the combined probability of occurrence of dry and critical years is less than one-third of the time, and because proportionate flows would be the same in wet and above normal years, and similar in below normal years.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 3 additional occurrence (for the 213 months included in the analysis) when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at Feather River mouth (Appendix F4, 4 vs. 2, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide changes in proportionate lower Feather River to Sacramento River flows, and water temperatures within the reported range of suitable spawning and initial rearing water temperatures, that would not unreasonably affect striped bass and its habitat.

Impact 10.2.4-17: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail spawning, embryo incubation, and initial rearing life stages in the lower Feather River occur from February through May. Over the entire 72-year period of simulated February through May estimates of usable flooded area (UFA), long-term average UFA in the lower Feather River would be 0.1 percent higher under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, with average estimates of UFA by water year type ranging from 0.9 percent higher during dry years to 0.4 percent lower during wet years. Changes of 10 percent or more in UFA would not occur over more than 10 percent of the cumulative UFA distributions (Appendix F4, 4 vs. 2, pgs. 879 through 880).

Over the entire 71-year simulation period, February through May monthly mean water temperatures below the Thermalito Afterbay Outlet, under both the CEQA Modified Flow Alternative and CEQA No Project Alternative would remain within the 45 - 75°F range of water temperatures reported to be suitable for splittail spawning (Appendix F4, 4 vs. 2, pgs. 825 through 836).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide generally equivalent conditions for Sacramento splittail in the lower Feather River. In conclusion, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent level of protection for, Sacramento splittail and its habitat, relative to the CEQA No Project Alternative.

SACRAMENTO RIVER BASIN

Sacramento River

The following sections describe and discuss flow and water temperature differences between the CEQA Modified Flow Alternative and the CEQA No Project Alternative, and potential effects on fisheries and aquatic resources in the Sacramento River immediately downstream of the Feather River confluence and at Freeport.

Model output generally demonstrates relatively minor changes in flows in the Sacramento River immediately downstream of the Feather River confluence. For example, over the 864 months simulated for the Sacramento River immediately below the Feather River confluence, only five monthly mean flows indicate that a 10 percent or greater change under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative – two decreases of 11.6 and 14.0 percent would occur in May, and three decreases of 12.4, 12.5, and 13.6 percent would occur in June. By contrast to May and June, measurable increases in flow would occur nearly 80 percent of the time during July and nearly 90 percent of the time during August. Model results indicate that the cumulative flow distributions for the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be nearly identical for most other months. Similar results are evident in the Sacramento River at Freeport (Appendix F4, 4 vs. 2, pgs. 907 through 918 and 1030 through 1041).

In addition to relatively minor changes in flow, water temperatures in the Sacramento River immediately downstream of the lower Feather River confluence generally would remain similar under the CEQA Modified Flow Alternative and the CEQA No Project Alternative during most months. In fact, of the 852 months simulated below the Feather River confluence, only ten months would indicate that measurably warmer (> 0.3°F) water temperatures under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, nine of which would occur during May, yet these changes would not exceed 0.6°F. By contrast to May, measurably cooler water temperatures would occur during the warm summer months of July and August in 23 and 26 months, respectively, for the 71 monthly simulations for each month under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. In general, water temperatures during other months would be essentially equivalent over the entire cumulative water temperature distributions for each month (Appendix F4, 4 vs. 2, pgs. 957 through 968). Similar results are evident in the Sacramento River at Freeport (Appendix F4, 4 vs. 2, pgs. 1055 through 1066).

With the exception of May and June, and July and August, flows and water temperatures simulated at the lower Feather River confluence and at Freeport under the CEQA Modified Flow Alternative would be generally equivalent to those under the CEQA No Project Alternative. During May and June, flows under the CEQA Modified Flow Alternative would be somewhat lower, and during May water temperatures would be generally warmer than the CEQA No Project Alternative. During July and August, flows under the CEQA Modified Flow Alternative would be generally equivalent or higher and water temperatures would be generally cooler than under the CEQA No Project Alternative.

Impact 10.2.4-18: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect winter-run Chinook salmon

The winter-run Chinook salmon adult immigration and holding life stage occurs in the Sacramento River from December through July. The flow and water temperature differences described above for May, June and July, between the CEQA Modified Flow Alternative and the CEQA No Project Alternative would not be expected to substantially affect the Sacramento River winter-run Chinook salmon adult immigration and holding life stage because:

- By May, the majority of adult winter-run Chinook salmon returning to the Sacramento River to spawn have already migrated upstream of the lower Feather River confluence;
- Only relatively minor flow decreases would occur during May and June, and relatively minor but more frequent flow increases would occur during July – resultant flows at the lower Feather River confluence would nearly always exceed 7,000 cfs during May, and 9,000 cfs during June and July (Appendix F4, 4 vs. 2, pgs. 883 through 894);
- The maximum water temperature increase between the alternatives would be 0.6°F at the lower Feather River confluence and 0.4°F at Freeport, which would occur during May;
- Overall, for the 568 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 64°F index value, and 1 increase above the 68°F index value immediately downstream of the Feather River confluence, and 1 increase above the 64°F index value at Freeport (Appendix F4, 4 vs. 2, pgs. 957 through 968 and 1055 through 1066); and
- During the warmest 25 percent of the cumulative water temperature distribution at the lower Feather River confluence, water temperatures would be measurably lower 20 percent of the time during July (Appendix F4, 4 vs. 2, pgs. 981 through 992).

The juvenile rearing and outmigration life stage extends from June through April. During June, flows under the CEQA Modified Flow Alternative would be somewhat lower than the CEQA No Project Alternative. During July and August, flows under the CEQA Modified Flow Alternative would be generally equivalent or higher, and water temperatures would be generally cooler than under the CEQA No Project Alternative. Although higher flows and cooler water temperatures may be beneficial, the differences between the alternatives would be relatively minor and would not be expected to substantially affect juvenile rearing and outmigration (Appendix F4, 4 vs. 2, pgs. 883 through 894, 957 through 968, 1006 through 1017, 1055 through 1066, and Appendix G, 4 vs. 2, pg. G-86).

In conclusion, in consideration of potential effects to all relevant life stages of winter-run Chinook salmon, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for, winter-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-19: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

Spring-run Chinook salmon adult immigration and holding extends from February through September. As discussed above, relatively minor and infrequent changes would occur in flows and/or water temperatures during May, June, July and August under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Overall, immediately downstream of the Feather River confluence, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 1 increase above the 64°F index value, and 3 increases above the 68°F index value - at Freeport, 1 increase above the 64°F index value (Appendix F4, 4 vs. 2, pgs. 883 through 894, 957 through 968, 1006 through 1017, and 1055 through 1066). The relatively minor flow decreases during May and June, and the relatively minor but more frequent flow increases during July and August, together with the relatively minor water temperature increases during May and the more frequent water temperature decreases during July and August, would not be of sufficient frequency and magnitude to substantively affect adult immigration and holding (Appendix G, 4 vs. 2, pg. G-88).

Juvenile rearing occurs year-round in the lower Feather River, and smolt emigration occurs from October through June. Overall, the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would result in 3 increases above the 68°F index value immediately downstream of the Feather River confluence, and 1 increase above the 70°F index value at Freeport. Based on the flow and water temperature modeling results described above, the relatively minor and infrequent changes that would occur in flows and water temperatures would not be expected to substantially affect spring-run Chinook salmon juvenile rearing and smolt emigration (Appendix F4, 4 vs. 2, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of spring-run Chinook salmon, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for, spring-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-20: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

Fall-run Chinook salmon adult immigration and holding extends from July through December, and juvenile rearing and outmigration extends from December through June. As discussed above, relatively minor and infrequent changes would occur in flows and/or water temperatures during May, June, July and August under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Overall, for the 568 months included in the juvenile rearing and outmigration analysis, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 3 increases above the 68°F index value immediately downstream of the Feather River confluence, and 1 increase above the 70°F index value at Freeport. The relatively minor flow decreases during May and June, and the relatively minor but more frequent flow increases during July and August, together with the relatively minor water temperature increases during May and the more frequent water temperature decreases during July and August, would not be of sufficient frequency and magnitude to substantively affect adult immigration and holding, or juvenile rearing and outmigration (Appendix F4, 4 vs. 2, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of fall-run Chinook salmon, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for, fall-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-21: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect late fall-run Chinook salmon

Late fall-run Chinook salmon adult immigration and holding extends from October through April, and juvenile rearing and outmigration extends from April through December. Overall, for the 568 months included in the juvenile rearing and outmigration analysis, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 3 increases above the 68°F index value immediately downstream of the Feather River confluence, and 1 increase above the 70°F index value at Freeport. Based on the flow and water temperature modeling results described above, the relatively minor and infrequent changes that occur in flows and water temperatures would not be expected to substantially affect late fall-run Chinook salmon adult immigration and holding, or juvenile rearing and outmigration (Appendix F4, 4 vs. 2, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of late fall-run Chinook salmon, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for, late fall-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-22: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect steelhead

In the Sacramento River, the steelhead adult immigration and holding life stage period extends from August through March, the juvenile rearing life stage occurs year-round, and the smolt emigration life stage extends from October through May. Overall, immediately downstream of the Feather River confluence, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 2 decreases below the 70°F index value during the adult immigration and holding life stage, and 3 increases above the 68°F index value, and 4 decreases below the 72°F index values during the juvenile rearing life stage. Based on the flow and water temperature modeling results described above, the relatively minor and infrequent changes that occur in flows and water temperatures would not be expected to substantially affect steelhead adult immigration and holding, juvenile rearing, or smolt emigration (Appendix F4, 4 vs. 2, pgs. 957 through 968).

In conclusion, in consideration of potential effects to all relevant life stages of steelhead, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for, steelhead and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-23: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect green sturgeon

Green sturgeon adult immigration and holding extends from February through July, adult spawning and embryo incubation extend from March through July, juvenile rearing occurs year-round, and juvenile emigration occurs May through September. As discussed above, relatively minor and infrequent changes would occur in flows and water temperatures during May, June, July and August under the CEQA Modified Flow Alternative, relative to the No Project Alternative. Overall, immediately downstream of the Feather River confluence, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in 3 increases above the 68°F index value during the adult spawning and the embryo incubation life stages. Based on the flow and water temperature modeling results described above, the relatively minor and infrequent changes that occur in flows and water temperatures would not be expected to substantially affect these green sturgeon life stages (Appendix F4, 4 vs. 2, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of green sturgeon, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for, green sturgeon and its habitat, relative to the CEQA No Project Alternative.

Impact 10.2.4-24: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect American shad

American shad adult immigration and spawning extends from April through June. As discussed above, minor and infrequent changes would occur in flows and/or water temperatures during May and June under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Based on the flow and water temperature modeling results described above, the minor and infrequent changes that occur in flows and water temperatures during May and June would not be expected to substantially affect American shad adult immigration and spawning. In conclusion, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent level of protection for, American shad and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 957 through 968 and 1055 through 1066).

Impact 10.2.4-25: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect striped bass

Striped bass adult spawning, embryo incubation and initial rearing extends from April through June. As discussed above, minor and infrequent changes would occur in flows and/or water temperatures during May and June under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Based on the flow and water temperature modeling results described above, the minor and infrequent changes that occur in flows and water temperatures during May and June would not be expected to substantially affect striped bass adult spawning, embryo incubation and initial rearing. In conclusion, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent level of protection for, striped bass and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 957 through 968 and 1055 through 1066).

Impact 10.2.4-26: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Splittail spawning, egg incubation, and initial rearing extends from February through May. Over the 72-year simulation period, the frequency with which the Yolo Bypass floodplains were inundated with Sacramento River water is similar under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative. The CEQA Modified Flow Alternative would provide one additional month (for the 288 months included in the analysis) with monthly mean flows greater than 56,000 cfs, which would occur during February of a wet year. These results suggest that the availability of splittail spawning, egg incubation, and initial rearing would be essentially the same under the CEQA Modified Flow Alternative and the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 883 through 894).

Over the 72-year simulation period, the February through May monthly mean water temperatures on the Sacramento River immediately downstream of the lower Feather River confluence under both the CEQA Modified Flow Alternative and the CEQA No Project Alternative would always be within the suitable range (i.e., 45°F to 75°F) for splittail spawning (Appendix F4, 4 vs. 2, pgs. 957 through 968).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the CEQA No Project Alternative, the CEQA Modified Flow Alternative would be expected to provide generally equivalent conditions for Sacramento splittail in the Sacramento River. In conclusion, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide an equivalent or higher level of protection for, Sacramento splittail and its habitat, relative to the CEQA No Project Alternative.

10.2.4.3 DELTA REGION

The evaluation of biological impacts on delta fisheries resources and their habitats use parameters established by the USFWS, CDFG, NMFS and others, including X2 locations, Delta outflows and E/I ratios, presented below.

X2 LOCATION

Over the entire 72-year period of simulated X2 locations, long-term average X2 locations would range from 0.2 km higher during February, to 0.1 lower during October and September, under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative. Under the CEQA Modified Flow Alternative, average X2 location by water year type would range from: 0.1 km higher during December through February and April to 0.3 km lower during September in wet years; 0.2 km higher during December to 0.2 km lower during September in above normal years; 0.1 km higher during January through April, June and July to 0.1 km lower during August and September in below normal years; 0.3 km higher during February to 0.1 km lower during September in dry years; and 0.3 km higher during June and July to 0.1 km lower during November in critical years (Appendix F4, 4 vs. 2, pg. 1189).

Cumulative X2 location distributions for the CEQA Modified Flow Alternative and the CEQA No Project Alternative generally would overlap during each month of the year, indicating that the X2 location under each scenario would be downstream of compliance points in the Delta with nearly equal probabilities. Although rare, monthly mean X2 locations would occasionally change by 1.0 km or more, including the following occasions: (1) three upstream movements (1.3 km, 1.1 km, and 1.6 km) during January; (2) one downstream movement (1.1 km) during February; (3) two upstream movements (1.2 km and 1.1 km) during June; and (4) one downstream movement (1.0 km) during September. During these months, there would be no instances when a 1.0 km or more change in X2 location would result in the movement of X2 past designated compliance points at Roe Island, Chipps Island, or the Confluence (Appendix F4, 4 vs. 2, pgs. 1214 through 1225).

Over the entire 72-year simulation period during the delta smelt spawning season (February through June), the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, would result in a 0.5 km or greater upstream shift while X2 is located between Chipps Island and the Confluence compliance points during 15 for the 360 months included in the analysis, and downstream shifts during 1 for the 360 months. These upstream/downstream shifts would occur 8 times during February and 8 times during June (Appendix F4, 4 vs. 2, pgs. 1190 through 1201).

DELTA OUTFLOW

Over the entire 72-year period of simulated Delta outflow, long-term average Delta outflow would range from 2 percent higher during August to 1 percent lower during November and December under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Under the CEQA Modified Flow Alternative, average Delta outflow by water year type would range from: 3 percent higher during August to 1 percent lower during November in wet years; 2 percent higher during August to 2 percent lower during November in above normal years; 2 percent higher during August to 2 percent lower during November and December in below normal years; 1 percent higher during March, July, and August to no change during other months in dry years; and no change during October through December, February through April, and July through September to 5 percent lower during May in critical years (Appendix F4, 4 vs. 2, pg. 1140).

Over the 72-year period of simulation, the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative would result in increases in the percentage of Delta outflows of five percent or more in 6 for the 864 months included in the analysis, and decreases of five percent or more in 29 for the 864 months (Appendix F4, 4 vs. 2, pgs. 1141 through 1152).

EXPORT-TO-INFLOW RATIO

Delta E/I ratio limits are built into the CALSIM modeling assumptions and, therefore, are consistently met under both the Proposed Action and Environmental Baseline during all months of the year. Nevertheless, over the entire 72-year period of simulated E/I ratios, long-term average E/I ratio would not change during all months except June, which would result in a 1 percent decrease under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pg. 1238). Under the CEQA Modified Flow Alternative, average E/I ratio by water year type would range from: 1 percent higher during July to no change during all other months in wet years; no change during all months in above normal and below normal years; 1 percent higher during December and January to 1 percent lower during June in dry years; and 1 percent higher during January to 3 percent lower during June in critical years. Over the 72-year period of simulation the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would result in a maximum increase of 3 percent, and a maximum decrease of 6 percent in the E/I ratios during any month included in the analysis. Moreover, increases in the percentage of E/I ratios would exceed 5 percent in only 1 for the 864 months included in the analysis (Appendix F4, 4 vs. 2, pgs. 1239 through 1250).

SALVAGE ESTIMATION

Delta Smelt

The combined overall estimated salvage for delta smelt at the CVP and SWP salvage facilities would decrease by 0.9 percent under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. The combined estimated salvage by water year type would change by: (1) 0.2 percent increase during wet years; (2) no change during above normal and below normal years; (3) 2.9 percent decrease during dry years; (4) 4.8 percent decrease during critical years, under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pg. 1336).

Winter-run Chinook Salmon

The combined overall estimated salvage for winter-run Chinook salmon at the CVP and SWP salvage facilities would not change under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. The combined estimated salvage by water year type would change by: (1) no change during wet, above normal, and below normal years; (2) 0.1 percent decrease during dry years; and (3) 0.1 percent increase during critical years, under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pg. 1324).

Spring-run Chinook Salmon

The combined overall estimated salvage and the combined estimated salvage by water year type for spring-run Chinook salmon at the CVP and SWP salvage facilities would not change under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pg. 1324).

Steelhead

The combined overall estimated salvage and the combined estimated salvage by water year for steelhead at the CVP and SWP salvage facilities would not change under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative with the exception of critical years which would result in a 0.2 percent decrease (Appendix F4, 4 vs. 2, pg. 1333).

Striped Bass

The combined overall estimated salvage for striped bass at the CVP and SWP salvage facilities would decrease by 1.2 percent under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. The combined estimated salvage by water year type would change by: (1) 1.6 percent increase during wet years; (2) 0.5 percent increase during above normal years; (3) 0.3 percent decrease during below normal years; (4) 3.6 percent decrease during dry years; and (5) 10.6 percent decrease during critical years, under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 1334 and 1335).

Impact 10.2.4-27: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect delta smelt

Model results indicate relatively minor and infrequent changes in the location of X2 in response to implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project

Alternative, as described above. The frequency and magnitude of these changes would not be expected to substantially affect delta smelt habitat.

Changes in monthly mean outflow in the Delta, as well as the E/I ratio, would be relatively infrequent and of minor magnitude under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. In addition, overall estimated delta smelt salvage at the CVP and SWP facilities would decrease by 0.9 percent under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated delta smelt salvage, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide a similar level of protection for, delta smelt and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 1140, 1189, and 1238).

Impact 10.2.4-28: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect winter-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, would not be expected to substantially affect winter-run Chinook salmon habitat. In addition, overall estimated winter-run Chinook salmon salvage at the CVP and SWP facilities would not change under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as winter-run Chinook salmon salvage, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide a similar level of protection for, winter-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 1140, 1189, and 1238).

Impact 10.2.4-29: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect spring-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, would not be expected to substantially affect spring-run Chinook salmon habitat. In addition, overall estimated spring-run Chinook salmon salvage at the CVP and SWP facilities would not change under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated spring-run Chinook salmon salvage, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide a similar level of protection for, spring-run Chinook salmon and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 1140, 1189, and 1238).

Impact 10.2.4-30: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect steelhead

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, would not be expected to substantially affect steelhead habitat. In addition, overall estimated steelhead salvage at the CVP and SWP facilities would not change under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated steelhead salvage, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide a similar level of protection for , steelhead and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 1140, 1189, and 1238).

Impact 10.2.4-31: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect striped bass

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, would not be expected to substantially affect striped bass habitat. In addition, overall estimated striped bass salvage at the CVP and SWP facilities would decrease by 1.2 percent under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated striped bass salvage, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide a similar level of protection for, striped bass and its habitat, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 1140, 1189, and 1238).

Impact 10.2.4-32: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) could affect other Delta fisheries resources

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, as described above under the CEQA Modified Flow Alternative relative to the CEQA No Project Alternative, would not be expected to substantially affect other Delta fisheries resources habitats. In conclusion, the CEQA Modified Flow Alternative would not unreasonably affect, and would provide a similar level of protection for, other Delta fisheries resources and their habitats, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 1140, 1189, and 1238).

10.2.4.4 EXPORT SERVICE AREA

SAN LUIS RESERVOIR

Impact 10.2.4-33: Decreases in San Luis Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June, although the majority of warmwater fish spawning occurs during the months of April and May. Simulated decreases in the water surface elevation of San Luis Reservoir by more than 6 feet per month would occur the same number of times for all months and water year types from April through June under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Therefore, the CEQA Modified Flow Alternative would not unreasonably affect San Luis Reservoir warmwater fisheries resources, and would provide an equivalent level of protection, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 1438 through 1449).

Impact 10.2.4-34: Decreases in San Luis Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Long-term average end of month storage and average storage by water year type under the CEQA Modified Flow Alternative would not change during any month in any year type relative to the CEQA No Project Alternative. Therefore, the CEQA Modified Flow Alternative would not unreasonably affect San Luis Reservoir coldwater fisheries resources, and would provide an equivalent level of protection, relative to the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs. 1339 and 1376).

10.2.5 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE CEQA YUBA ACCORD ALTERNATIVE COMPARED TO THE CEQA EXISTING CONDITION

10.2.5.1 YUBA REGION

NEW BULLARDS BAR RESERVOIR

Impact 10.2.5-1: Decreases in New Bullards Bar Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June, with the majority of warmwater fish spawning occurring during the months of April and May. Decreases in the water surface elevation of New Bullards Bar Reservoir by more than 6 feet per month from March through June would occur approximately 10 percent more often under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition. These reductions in water surface elevations would not be anticipated to result in substantial reductions in warmwater fish spawning success because these potential decreases in water surface elevation would not be expected to occur during more than two months of any spawning season. In addition, a 60 percent nest success rate or greater would be achieved during some months of any annual spawning season, which would be expected to provide sufficient recruitment of individuals into the population over the 72-year simulation period. Therefore, changes in water surface elevations that could occur under the CEQA Yuba Accord Alternative would result in a less than significant impact on New Bullards Bar Reservoir warmwater fisheries, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 75 through 86).

Impact 10.2.5-2: Decreases in New Bullards Bar Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

The CEQA Yuba Accord Alternative would result in long-term average New Bullards Bar Reservoir storage of approximately 809 TAF in April to 551 TAF in November (Appendix F4, 3 vs. 1, pg. 1). This reduction corresponds to a change in water surface elevation from approximately 1,920 feet msl to 1,851 feet msl. Under the CEQA Existing Condition, the November long-term average storage in New Bullards Bar Reservoir would be approximately 567 TAF with a corresponding elevation of 1,857 feet msl (Appendix F4, 3 vs. 1, pg. 50).

Anticipated reductions in reservoir storage associated with the CEQA Yuba Accord Alternative would not be expected to adversely impact the New Bullards Bar Reservoir's coldwater fisheries because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample coldwater pool reserves. Throughout the period of operations of New Bullards Bar Reservoir

(1969 through present), which encompasses the most extreme critically dry year on record, the coldwater pool in New Bullards Bar Reservoir has not been depleted. In fact, since 1993, coldwater pool availability in New Bullards Bar Reservoir has been sufficient to accommodate year-round utilization of the lower river outlets from the dam to the New Colgate tunnel, at the direction provided by CDFG, provide the coldest water possible to the lower Yuba River. Therefore, potential reductions in coldwater pool storage would not be expected to adversely affect New Bullards Bar Reservoir's coldwater fisheries because: (1) coldwater habitat would remain available in the reservoir during all months of the CEQA Yuba Accord Alternative; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fish. Therefore, changes in end-of-month storage that could occur under the CEQA Yuba Accord Alternative would result in a less than significant impact on New Bullards Bar Reservoir coldwater fisheries, relative to the CEQA Existing Condition.

Lower Yuba River

The following sections describe and discuss flow and water temperature differences between the CEQA Yuba Accord Alternative and the CEQA Existing Condition, and potential effects on fisheries and aquatic resources in the lower Yuba River.

Impact 10.2.5-3: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The adult immigration and holding life stage primarily extends from March through October. Evaluation of flows at Marysville that would occur under the CEQA Yuba Accord Alternative and the CEQA Existing Condition indicate that both alternatives would provide adequate flows for adult spring-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam (Appendix F4, 3 vs.1, pg. 272). Also, under the CEQA Yuba Accord Alternative and the CEQA Existing Condition, flows in the lower Yuba River throughout the upstream migration period generally would remain within the range sufficient to allow adequate passage of adult spring-run Chinook salmon through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville would result in the same number of occurrences (4 for the 576 months included in the analysis) during which flows at the Daguerre Point Dam fish ladders would exceed 10,000 cfs under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 273 through 284). Finally, under the CEQA Yuba Accord Alternative and the CEQA Existing Condition, stages at Smartville throughout the adult holding period would remain similar. Overall, examination of monthly mean stage simulated at Smartville would result in 2 decreases of one foot or more (for the 576 months included in the analysis) under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 162 through 173). These relatively infrequent and minor changes in stage would not affect adult spring-run Chinook salmon holding habitat conditions, particularly due to the deep nature of the pools in the Narrows Reach below Englebright Dam.

During the March through October adult immigration and holding life stage, water temperatures at Smartville, under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition, generally would remain at or below 58°F, which is below the lowest water temperature index value (60°F), and therefore would remain suitable, for this life stage (Appendix F4, 3 vs. 1, pg. 174).

Simulated water temperatures at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition generally would not exceed 60°F over the entire cumulative water temperature distributions from March through August, and during October. However, during September under the CEQA Yuba Accord Alternative, water temperatures would remain below 60°F with about a 90 percent probability, by contrast to about a 70 percent probability under the CEQA Existing Condition. Measurable water temperature reductions (from about 1 - 2°F), and therefore more suitable conditions, would occur during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures equal or exceed 60°F under the CEQA Existing Condition. Overall, during the entire March through October adult immigration and holding period at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 26 decreases below the 60°F index value, 1 increase above the 64°F index value, and 2 increases above the 68°F index value (Appendix G, 3 vs. 1, pgs. G-102 through G-104).

In addition, while the presence of spring-run Chinook salmon below Daguerre Point Dam during the immigration and holding life stage is believed to be transitory, the cumulative water temperature distributions under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, indicate that generally cool (< 60°F), and therefore more suitable water temperatures at Marysville during March, April, and October. During May and June under relatively warm water temperature conditions, measurably lower (from about 0.5 – 3.8°F) water temperatures would occur 100 percent of the time. During July and August at Marysville, measurably lower, and therefore more suitable, water temperatures also would occur under relatively warm water temperature conditions, although measurable water temperature increases would consistently occur from intermediate to cool water temperature conditions. However, during August, measurable water temperature increases would occur when water temperatures would be below 60°F, and therefore would remain suitable for this life stage. Overall, during the March through October adult immigration and holding life stage at Marysville, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in 8 decreases below the 60°F index value, 39 decreases below the 64°F index value, and 9 decreases below the 68°F index value (Appendix F4, 3 vs. 1, pgs. 371 through 382).

Spring-run Chinook salmon spawning reportedly occurs above Daguerre Point Dam from September through November. During these months, the annual spawning habitat availability under the CEQA Yuba Accord Alternative would be similar to that under the CEQA Existing Condition (long-term average of 89.2 percent versus 89.1 percent of the maximum WUA) (Appendix F4, 3 vs. 1, pg. 395). The CEQA Yuba Accord Alternative would achieve over 90 percent of maximum WUA with a 72 percent probability, while the CEQA Existing Condition would achieve over 90 percent of maximum WUA with a 65 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 3 vs. 1, pg. 399).

The spring-run Chinook salmon spawning habitat analysis also emphasized the month of September, because this is the only month during the spring-run Chinook salmon spawning period that is assumed to not temporally overlap with fall-run Chinook salmon spawning (CDFG 2000). For September, spawning habitat availability, expressed as percent maximum WUA, under the CEQA Yuba Accord Alternative would be slightly higher than under the CEQA Existing Condition (long-term average of 90.1 percent versus 87.2 percent of maximum WUA) (Appendix F4, 3 vs. 1, pg. 395). Overall, for the month of September, the CEQA Yuba Accord Alternative would achieve over 90 percent of maximum WUA with about a 62 percent probability, whereas the CEQA Existing Condition would achieve over 90 percent of maximum

WUA with about a 55 percent probability. Overall, increases of 10 percent or more in spawning habitat availability would occur over about 9.9 percent (7 for the 71 years) of the September cumulative WUA distributions (Appendix F4, 3 vs. 1, pg. 397).

Water temperatures at Smartville during the September through November spawning period generally would not exceed 56°F, and therefore would remain suitable for this life stage (Appendix F4, 3 vs. 1, pgs. 175 through 186). Simulated water temperatures at Daguerre Point Dam during November would not exceed 56°F, and therefore would remain suitable for adult spawning. During September, simulated water temperatures at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would exceed 56°F over the entire cumulative water temperature distributions. Under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, water temperatures would be essentially equivalent over approximately 50 percent, and would be measurably lower over approximately 30 percent of the cumulative water temperature distributions during September. During relatively warm water temperature conditions, water temperatures under the CEQA Yuba Accord Alternative would be lower, and therefore more suitable, than under the CEQA Existing Condition with about a 90 percent probability during September. During October, simulated water temperatures at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would exceed 56°F with slightly more than a 90 percent probability. However, during October, simulated water temperatures at Daguerre Point Dam under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would be essentially equivalent over approximately 55 percent, and would be measurably lower, and therefore more suitable, over approximately 40 percent of the cumulative water distribution. During October at intermediate to warm water temperature conditions, water temperatures would be typically lower, and therefore more suitable, under the CEQA Yuba Accord Alternative than under the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 248 through 259). Overall, during the entire September through November spawning period, at Daguerre Point Dam the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 increase above the 56°F index value, 6 increases above the 58°F index value, 11 decreases below the 60°F index value, and 7 decreases below the 62°F index value (Appendix G, 3 vs. 1, pgs. G-102 through G-104).

The embryo incubation life stage for spring-run Chinook salmon in the lower Yuba River generally occurs between September and March. As indicated above for the spawning life stage, water temperatures at Daguerre Point Dam under the CEQA Yuba Accord Alternative would generally be cooler, and therefore more suitable for embryo incubation, than the CEQA Existing Condition during the September through November period. Between December and March, water temperatures would not exceed 53°F, would not approach the lowest water temperature index value (56°F), and therefore would remain suitable, at Daguerre Point Dam under either the CEQA Yuba Accord Alternative or the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 248 through 259).

Spring-run Chinook salmon juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to spring-run Chinook salmon juveniles.

Simulated water temperatures at Smartville and at Daguerre Point Dam generally would remain below the lowest water temperature index value (60°F), and therefore would remain suitable for this life stage year-round, under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition. At Marysville, water temperatures generally would remain below the lowest water temperature index value (60°F), and therefore would remain suitable for this life stage from November through April, under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition. During May and June under relatively warm water temperature conditions, water temperatures would be measurably lower (from 0.5 to 3.8°F), and therefore more suitable, 100 percent of the time. During July and August at Marysville, measurably lower, and therefore more suitable, water temperatures also would occur under relatively warm water temperature conditions, although measurable water temperature increases consistently would occur from intermediate to cool water temperature conditions. However, during August, measurable water temperature increases would occur when water temperatures are below 60°F, and therefore would remain suitable for this life stage. During September, water temperatures under the CEQA Yuba Accord Alternative would exceed 60°F nearly 95 percent of the time, by contrast to the CEQA Existing Condition (about 85 percent of the time), reflecting the measurable increases that would occur under cool to intermediate water temperature conditions. However, measurably cooler (nearly 0.5 to over 5°F), and therefore more suitable, water temperatures would occur under warm water temperature conditions when water temperatures represent more stressful conditions under the CEQA Existing Condition, ranging from about 63°F to more than 69°F. During October at Marysville, generally measurably cooler, and therefore more suitable, water temperatures would occur under the CEQA Yuba Accord Alternative, particularly when water temperatures would exceed 60°F under the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 199 through 210, 248 through 259, and 371 through 382).

Overall, during the year-round juvenile rearing life stage at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 26 decreases below the 60°F index value, 1 increase above the 63°F index value, 3 increases above the 65°F index value, 2 increases above the 68°F index value, and no change at the 70°F or 75°F index values. Overall, at Marysville, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 8 decreases below the 60°F index value, 21 decreases below the 63°F index value, 40 decreases below the 65°F index value, 9 decreases below the 68°F index value, 2 decreases below the 70°F index value, and 1 increase above the 75°F index value (Appendix G, 3 vs. 1, pgs. G-102 through G-104).

The spring-run Chinook salmon smolt emigration period is believed to extend from November through June, although based on CDFG's run-specific determinations, the vast majority (about 94 percent) of spring-run Chinook salmon were captured as post-emergent fry during November and December, with a relatively small percentage (nearly 6 percent) of individuals remaining in the lower Yuba River and captured as YOY from January through March. Only 0.6 percent of the juvenile Chinook salmon identified as spring-run was captured during April, 0.1 percent during May, and none were captured during June. During November and December, flows generally would be frequently measurably higher, particularly during low to intermediate flow conditions at Smartville and at Marysville, which may facilitate smolt emigration. During January and February at Smartville and at Marysville, flows would be characterized by measurable flow reductions at intermediate flow levels, which would not be expected to substantively affect smolt emigration, by contrast to measurable increases during low flow conditions. During March at Smartville, measurable decreases would occur at intermediate to high flow levels, whereas at Marysville, measurable decreases would occur primarily at intermediate to low flow levels, yet remain above 800 cfs about 90 percent of the time. During April, May and June at Smartville and at Marysville, flow decreases would occur at intermediate to high flow levels, but substantive and consistent increases would occur under low flow conditions. In fact, under low flow conditions, a ten percent or greater flow increase would occurs nearly 90 percent of the time or more during April, May and June at both locations. Although, based on evaluation of CDFG's most recent five years of Chinook salmon RST monitoring data, few spring-run Chinook salmon smolts would be expected to emigrate during spring, the CEQA Yuba Accord Alternative would provide improved conditions for smolt emigration when flows would otherwise be relatively low under the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 125 through 136 and 297 through 308).

During the November through June smolt emigration life stage, water temperatures at Smartville and Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition generally would remain below 60°F, and therefore would remain suitable for this life stage (Appendix F4, 3 vs.1, pgs. 175 through 186, 199 through 210, 224 through 235, and 248 through 259).

At Marysville, water temperatures generally would remain below the lowest water temperature index value (60°F), and therefore would remain suitable for this life stage from November through April, under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition. During May and June under relatively warm water temperature conditions, water temperatures would be measurably lower (from 0.5 to 3.8°F), and therefore more suitable, 100 percent of the time (Appendix F4, 3 vs. 1, pgs. 347 through 358 and 371 through 382).

Overall, during the entire November through June smolt emigration period at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 9 decreases below the 60°F index value, 1 increase above the 63°F index value, and no changes at the 68°F and 70°F index values (Appendix F4, 3 vs. 1, pgs. 248 through 259). Overall at Marysville, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 18 decreases below the 60°F index value, 2 increases above the 63°F index value, 1 decrease below the 68°F index value, and no changes at the 70°F index value (Appendix G, 3 vs. 1, pgs. G-102 through G-104).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to provide:

- Improved adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) similar holding habitat conditions above Daguerre Point Dam; (4) measurable water temperature reductions (from about 1 - 2°F), and therefore more suitable conditions, during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures equal or exceed 60°F; and (5) cooler, and therefore more suitable, water temperatures during the 25 percent warmest water temperature conditions during May and June, when water temperatures represent stressful conditions in the lower section of the river

- Improved spawning conditions due to: similar spawning habitat availability during the entire September through November adult spawning period; higher spawning habitat availability, with increases of 10 percent or more in spawning habitat availability occurring nearly 10 percent of the time during September separately as a temporally distinct month; and generally lower and therefore more suitable water temperatures, particularly during about 30 to 40 percent of the warmest water temperature conditions at Daguerre Point Dam during September and October

- Improved embryo incubation conditions due to frequently and substantially lower, and therefore more suitable water temperatures, particularly during about 30 to 40 percent of the warmest water temperature conditions at Daguerre Point Dam during September and October
- Improved over-summer/early fall juvenile rearing conditions, due to consistently and substantially lower, and therefore more suitable, water temperatures at Marysville under relatively warm water temperature conditions (about the warmest 15 to 30 percent of water temperature conditions) from May through October
- Improved smolt emigration conditions due to higher flows during approximately the lowest 25 to 75 percent of flow conditions from November through February, which may facilitate smolt emigration; and improved conditions for smolt emigration during April, May and June, when flows would be substantially higher during approximately the lowest 25 percent of flow conditions throughout the river; and generally suitable water temperatures throughout the majority of the smolt emigration period

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in a beneficial impact to lower Yuba River spring-run Chinook salmon.

Impact 10.2.5-4: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The adult immigration and holding life stage for fall-run Chinook salmon in the lower Yuba River primarily extends from August through November. Evaluation of flows at Marysville that would occur under the CEQA Yuba Accord Alternative and the CEQA Existing Condition indicate that both alternatives would provide adequate flows for adult fall-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam. Also, under the CEQA Yuba Accord Alternative and the CEQA Existing Condition, flows in the lower Yuba River throughout the upstream migration period would remain within the range sufficient to allow adequate passage of adult fall-run Chinook salmon through the Daguerre Point Dam fish ladders. Under the CEQA Yuba Accord Alternative, flows at Smartville and Marysville would be higher during relatively low flow conditions from August through November; higher flows of ten percent or more would occur generally ranging from about a 75 percent probability to a 100 percent probability. During the August through November adult immigration and holding life stage, water temperatures at Smartville, under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition, generally would remain at or below 56°F, which is below the lowest water temperature index value (60°F), and therefore would remain suitable, for this life stage (Appendix F4, 3 vs. 1, pgs. 125 through 136 and 297 through 308).

Simulated water temperatures at Daguerre Point Dam under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition generally would remain below 60°F during August, October, and November. However, during September under the CEQA Yuba Accord Alternative, water temperatures would remain below 60°F with about a 90 percent probability, by contrast to about a 70 percent probability under the CEQA Existing Condition. Measurable water temperature reductions (from about 1 - 2°F), and therefore more suitable conditions, would occur during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures would equal or exceed 60°F under the CEQA

Existing Condition. Overall, during the entire August through November adult immigration and holding period at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 14 decreases below the 60°F index value, 1 increase above the 64°F index value, and 1 increase above the 68°F index value (Appendix F4, 3 vs. 1, pgs. 175 through 186 and 224 through 235).

During August (of the August through November adult immigration and holding life stage) at Marysville, measurably lower, and therefore more suitable, water temperatures would occur under relatively warm water temperature conditions, although measurable water temperature increases consistently would occur from intermediate to cool water temperature conditions. However, these measurable water temperature increases during August would occur when water temperatures are below 60°F, and therefore would remain suitable for this life stage. During September, water temperatures under the CEQA Yuba Accord Alternative would exceed 60°F nearly 95 percent of the time, by contrast to the CEQA Existing Condition (about 85 percent of the time), reflecting the measurable increases that would occur under cool to intermediate water temperature conditions. However, measurably cooler (nearly 0.5 to over 5°F), and therefore more suitable, water temperatures would occur under warm water temperature conditions when water temperatures represent more stressful conditions under the CEQA Existing Condition, ranging from about 63°F to more than 69°F. During October at Marysville, generally measurably cooler, and therefore more suitable, water temperatures would occur under the CEQA Yuba Accord Alternative, particularly when water temperatures would exceed 60°F under the CEQA Existing Condition. At Marysville, water temperatures generally would remain below the lowest water temperature index value (60°F), and therefore would remain suitable for this life stage during November, under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition. Overall at Marysville, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, would result in 7 decreases below the 60°F index value, 23 decreases below the 64°F index value, and 5 decreases below the 68°F index value (Appendix F4, 3 vs. 1, pgs. 371 through 382).

Fall-run Chinook salmon spawning occurs in the lower Yuba River from October through December, and may extend into January. During these months, the annual spawning habitat availability under the CEQA Yuba Accord Alternative would be slightly lower than under the CEQA Existing Condition (long-term average of 87.5 percent versus 88.6 percent of the maximum WUA) (Appendix F4, 3 vs. 1, pg. 400). The CEQA Yuba Accord Alternative would achieve over 90 percent of maximum WUA with a 66 percent probability, while the CEQA Existing Condition would achieve over 90 percent of maximum WUA with a 70 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 3 vs. 1, pg. 402).

Water temperatures at Smartville during the October through December adult spawning period would not exceed 56°F, and therefore would remain suitable for this life stage (Appendix F4, 3 vs. 1, pgs. 199 through 210). Simulated water temperatures at Daguerre Point Dam and Marysville during November and December also would not exceed 56°F. During October at Daguerre Point Dam, water temperatures would be essentially equivalent about 55 percent of the time, and would be measurably cooler more than 40 percent of the time. Nearly all of the measurable water temperature reductions would occur when water temperatures would exceed 56°F, and therefore represent improved spawning water temperature conditions. During October at Marysville, water temperatures would be essentially equivalent about 20 percent of the time, measurably cooler 50 percent of the time, and measurably warmer 30 percent of the time. The water temperature reductions generally would occur at intermediate to warm water temperatures, and therefore represent improved spawning water temperature conditions. Overall, the CEQA Yuba Accord Alternative would result in 1 increase above the 56°F index value, 1 increase above the 60°F index value, and no changes at other index values at Daguerre Point Dam, and no changes at the 56°F index value, 6 increases above the 58°F index value, 12 decreases below the 60°F index value, and no changes at the 62°F index value at Marysville (Appendix F4, 3 vs. 1, pgs. 248 through 259 and 371 through 382).

The embryo incubation period for fall-run Chinook salmon extends from October through March. In addition to the trends described above, between January and March, water temperatures would not exceed 54°F, would not approach the lowest water temperature index value (56°F), and therefore would remain suitable, at Daguerre Point Dam and Marysville under the CEQA Yuba Accord Alternative and the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 248 through 259 and 371 through 382).

Juvenile fall-run Chinook salmon rear in and emigrate from the lower Yuba River between December and June, although based on CDFG's run-specific determinations, the majority (about 81 percent) of fall-run Chinook salmon are captured moving downstream from December through March, with decreasing numbers captured during April (about 9 percent), May (about 7 percent), and June (about 3 percent). The discussion of flow and water temperature changes provided for spring-run Chinook salmon smolt emigration (see above) encompasses the entire fall-run Chinook salmon juvenile rearing and outmigration time period. The only differences are that the juvenile fall-run Chinook salmon rearing and outmigration period encompasses one less month (November), and includes slightly different water temperature index values (Appendix G, 3 vs. 1, pgs. G-106 through G-107).

Overall, during the entire December through June juvenile rearing and outmigration period at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 9 decreases below the 60°F index value, 1 increase above the 63°F index value, and no changes at the 65°F, 68°F and 70°F index values (Appendix F4, 3 vs. 1, pgs. 248 through 259). Overall at Marysville, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, would result in 18 decreases below the 60°F index value, 2 increases above the 63°F index value, 13 decreases below the 65°F index value, and 1 decrease below the 68°F index value, and no changes at the 70°F index value (Appendix G, 3 vs. 1, pgs. G-106 through G-107).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) measurable water temperature reductions (from about 1 - 2°F), and therefore more suitable conditions, during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures equal or exceed 60°F; (4) measurably lower, and therefore more suitable, water temperatures under relatively warm (about 62°F to about 70°F) water temperature conditions during August, and substantially lower (generally about 0.5 – 5°F), and therefore more suitable, water temperatures during September when water temperatures would otherwise be at their highest (about 63°F to more than 69°F) and, therefore, most stressful levels at Marysville; (5) generally measurably cooler, and therefore more suitable, water temperatures, particularly when water temperatures would exceed 60°F during October at Marysville

- Generally equivalent or improved spawning conditions due to slightly lower spawning habitat availability during the adult spawning period, but generally lower and therefore more suitable water temperatures during October at Daguerre Point Dam when water temperatures under the CEQA Existing Condition would exceed 56°F, and measurably cooler water temperatures 50 percent of the time at Marysville, generally at intermediate to warm water temperatures, which therefore represent improved spawning water temperature conditions
- Improved embryo incubation conditions due to lower (and therefore more suitable) water temperatures during October, particularly during warm water temperature conditions (approximately the warmest 50 percent of water temperature conditions) at Daguerre Point Dam and at Marysville
- Improved juvenile rearing and outmigration conditions due to higher flows during approximately the lowest 25 to 75 percent of flow conditions from December through February, which may facilitate juvenile rearing and outmigration; and improved conditions for juvenile rearing and outmigration during April, May and June, when flows would be substantially higher during approximately the lowest 25 percent of flow conditions throughout the river; and lower water temperatures during the 25 percent warmest water temperature conditions during May and June in the lower section of the river

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in a beneficial impact to lower Yuba River fall-run Chinook salmon.

Impact 10.2.5-5: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the lower Yuba River extends from August through March. Evaluation of flows at Marysville would occur under the CEQA Yuba Accord Alternative and the CEQA Existing Condition indicates that both alternatives would provide adequate flows for adult steelhead upstream critical riffle passage below Daguerre Point Dam. Also, under the CEQA Yuba Accord Alternative and the CEQA Existing Condition, flows in the lower Yuba River throughout the upstream migration period generally would remain within the range sufficient to allow adequate passage of adult steelhead through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville would result in 1 additional occurrence during which flows at the Daguerre Point Dam fish ladders would exceed 10,000 cfs under the CEQA Yuba Accord Alternative (12 for the 576 months included in the analysis), relative to the CEQA Existing Condition (11 for the 576 months) (Appendix F4, 3 vs. 1, pgs. 273 through 284).

During the adult immigration and holding life stage, flows under the CEQA Yuba Accord Alternative at Smartville and Marysville would be higher during relatively low flow conditions from August through November; higher flows of ten percent or more generally would occur from about a 75 percent probability to a 100 percent probability. During December, flows generally would be frequently measurably higher, particularly during low to intermediate flow conditions at Smartville and at Marysville. During January and February at Smartville and at Marysville, flows would be typically characterized by measurable flow reductions at intermediate flow levels, which would not be expected to substantively affect adult immigration and holding, by contrast to measurable increases during low flow conditions. During March at Smartville, measurable decreases would occur at intermediate to high flow levels, whereas at Marysville, measurable decreases would occur primarily at intermediate to low flow levels, yet would remain above 800 cfs about 90 percent of the time (Appendix F4, 3 vs. 1, pgs. 125 through 136 and 297 through 308).

During the adult immigration and holding life stage, water temperatures at Smartville during August, September, and October would always exceed 52°F, yet remain at or below 56°F under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition. During November, water temperatures would be slightly warmer during the warmest water temperature conditions, but would remain at or below 52°F approximately 90 percent of the time. From December through March, water temperatures would remain below 52°F under both alternatives (Appendix F4, 3 vs. 1, pgs. 248 through 259 and 371 through 382).

At Daguerre Point Dam from August through October, water temperatures would be typically lower under the warmest water temperature conditions, when water temperatures would exceed 56°F, and therefore would be more suitable under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition. By contrast, water temperatures would be consistently warmer under the CEQA Yuba Accord Alternative during August and September at cool to intermediate water temperature conditions, and may be less suitable because water temperatures would approach or exceed the 56°F index value. During November, slight increases typically would occur when water temperatures would be above 52°F, yet remain below 54°F. At Daguerre Point Dam, water temperatures generally would remain at or below 52°F under both Alternatives from December through March. Similar trends are evident at Marysville, although water temperatures during the warmer months of August through October would be 2 – 3°F higher at Marysville than at Daguerre Point Dam.

Overall, during the adult immigration and holding life stage at Smartville, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 4 increases above the 52°F index value, 5 increases above the 56°F index value, and no change at the 70°F index value. At Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 5 increases above the 52°F index value, 3 increases above the 56°F index value, and no changes at the 70°F index value. At Marysville, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 5 decreases below the 52°F index value, and 1 increase above the 56°F index value, and no change at the 70°F index value (Appendix F4, 3 vs. 1, pgs. 248 through 259 and 371 through 382).

The steelhead spawning season generally extends from January through April, primarily occurring in reaches upstream of Daguerre Point Dam. During these months, the annual spawning habitat availability under the CEQA Yuba Accord Alternative would be slightly lower than under the CEQA Existing Condition (long-term average of 36.9 percent versus 38.5 percent of the maximum WUA) (Appendix F4, 3 vs. 1, pg. 403). The CEQA Yuba Accord Alternative would achieve over 80 percent of maximum WUA with about a 10 percent probability, whereas the CEQA Existing Condition would achieve over 80 percent of maximum WUA with about a 15 percent probability; both alternatives would achieve over 50 percent of maximum WUA with about a 35 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 3 vs. 1, pg. 405).

From January through April at Smartville and from January through March at Daguerre Point Dam, water temperatures consistently would remain below 52°F, which is the lowest water temperature index value for this life stage, and therefore would remain suitable for adult spawning. During April at Daguerre Point Dam, water temperatures would be measurably and consistently lower under the CEQA Yuba Accord Alternative under relatively warm water temperature conditions (54 – 55°F) for this month (Appendix F4, 3 vs. 1, pgs. 199 through 210 and 248 through 259).

Overall, during the adult spawning life stage, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 2 increases above the 52°F index value, and no changes at other index values at Smartville. At Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 increase above the 52°F index value, 1 decrease below the 54°F index value, and no changes at other index values (Appendix F4, 3 vs. 1, pgs. 199 through 210 and 248 through 259).

The embryo incubation period for steelhead in the lower Yuba River general overlaps with the spawning period, but extends into May. During May, water temperatures at Smartville under the CEQA Yuba Accord Alternative would be generally equivalent to the water temperatures under the CEQA Existing Condition over the most of the cumulative water temperature distribution (Appendix F4, 3 vs. 1, pgs. 175 through 186). Water temperatures at Daguerre Point Dam during May under the CEQA Yuba Accord Alternative would be essentially equivalent to the water temperatures under the CEQA Existing Condition over approximately 55 percent of the cumulative water temperature distribution, would be measurably lower with about a 25 percent probability, and would be measurably higher with about a 20 percent probability. Under the CEQA Yuba Accord Alternative, the measurably lower, and therefore more suitable water temperatures would occur during relatively warm water temperature conditions, when water temperatures are most stressful. Overall, during the embryo incubation life stage at Smartville the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in 7 increases above the 52°F index value, and no change at other index values. At Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 increase above the 52°F index value, 1 decrease below the 54°F index value, 11 decreases below the 57°F index value, and no changes at the 60°F index value (Appendix F4, 3 vs. 1, pgs. 224 through 235).

Steelhead juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles.

The discussion of general water temperature changes provided for spring-run Chinook salmon year-round juvenile rearing (see above) applies to the steelhead juvenile rearing life stage. The only difference is that the steelhead juvenile rearing life stage includes slightly different water temperature index values. Overall, during the year-round juvenile rearing life stage at Smartville, no changes at any index value would be observed. At Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 3 increases above the 65°F index value, 2 increases above the 68°F index value, and no change at the 72°F or 75°F index values (Appendix F4, 3 vs. 1, pgs. 175 through 186 and 224 through 235). Overall, at Marysville, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 40 decreases below the 65°F index value, 9 decreases below the 68°F index value, no changes at the 72°F index value, and 1 increase above the 75°F index value (Appendix F4, 3 vs. 1, pgs. 347 through 358).

The steelhead smolt emigration period is believed to extend from October through May. The discussion of flow and water temperature changes provided for spring-run Chinook salmon smolt emigration (see above) encompasses nearly the entire fall-run Chinook salmon juvenile rearing and outmigration time period. The only differences are that the steelhead smolt emigration period encompasses one additional month (October) and one less month (June), and includes different water temperature index values. During October, flows under the CEQA Yuba Accord Alternative would be higher during relatively low to intermediate flow conditions, and higher flows of ten percent or more would occur with about a 50 percent probability at Smartville and at Marysville (Appendix F4, 3 vs. 1, pgs. 125 through 136 and 297 through 308).

During the smolt emigration life stage, water temperatures at Smartville during October would always exceed 52°F, yet would remain below 55°F with about a 95 percent probability under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 199 through 210). At Daguerre Point Dam during October, water temperatures would be lower under intermediate to warm water temperature conditions, when water temperatures would exceed 55°F, and therefore would be more suitable under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 248 through 259). At Marysville during October, a similar trend is evident, although water temperatures would be generally about 2°F higher at Marysville than at Daguerre Point Dam (Appendix F4, 3 vs. 1, pgs. 371 through 382).

Overall, during the entire October through May smolt emigration period at Smartville, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 11 increases above the 52°F index value, 2 increases above the 55°F index value, and no change at the 59°F index value. Overall, during the entire October through May smolt emigration period at Daguerre Point Dam, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 6 increases above the 52°F index value, 17 decreases below the 55°F index value, and 2 increases above the 59°F index value. Overall, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 6 decreases below the 52°F index value, 2 increases above the 55°F index value, and 37 decreases below the 59°F index value (Appendix F4, 3 vs. 1, pgs. 199 through 210 and 248 through 259).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) frequently cooler and therefore more suitable water temperatures under approximately 30 percent of the warmest water temperature conditions during the fall (i.e., August through October) portion of this life stage; and (4) substantially lower (generally about 0.5 – 5°F), and therefore more suitable, water temperatures during September when water temperatures would otherwise be at their highest and, therefore, most stressful levels

- Generally equivalent spawning conditions due to slightly lower spawning habitat availability, but measurably and consistently lower water temperatures under relatively warm water temperature conditions (54 – 55°F) during April at Daguerre Point Dam
- Generally equivalent or improved embryo incubation conditions due to measurably and consistently lower water temperatures under relatively warm water temperature conditions (54 – 55°F) during April at Daguerre Point Dam; and measurably lower, and therefore more suitable water temperatures during May under relatively warm water temperature conditions (i.e., the warmest 25 percent of water temperature conditions)
- Improved over-summer rearing conditions, due to consistently and substantially lower, and therefore more suitable, water temperatures at Marysville under relatively warm water temperature conditions (generally the warmest 25 percent of water temperature conditions) from May through September
- Improved smolt emigration conditions due to higher flows during approximately the lowest 25 to 75 percent of flow conditions from October through February, which may facilitate juvenile rearing and outmigration; and improved conditions for juvenile rearing and outmigration during April and May, when flows would be substantially higher during approximately the lowest 25 percent of flow conditions throughout the river; and lower water temperatures during the 25 percent warmest water temperature conditions during May in the lower section of the river

In conclusion, in consideration of potential impacts to all life stages of steelhead, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in a beneficial impact to lower Yuba River steelhead.

Impact 10.2.5-6: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect green sturgeon

Flows during the green sturgeon immigration and holding (February through July) and adult spawning and embryo incubation (March through July) life stage periods would be expected to allow adequate upstream migration and spawning habitat availability, under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Overall, under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, would result in 2 increases above the 61°F index value for adult immigration and holding, 4 decreases below the 68°F index value for adult spawning, and 4 decreases below the 68°F index value for embryo incubation (Appendix F4, 3 vs. 1, pgs. 199 through 210, 248 through 259, and 371 through 382).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juveniles. Simulated water temperature conditions at Marysville would generally be substantially lower, and therefore more suitable, under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition under relatively warm water temperature conditions during the over-summer rearing period. From June through August under relatively warm water temperature conditions, water temperatures would be consistently and measurably lower (from 0.5 to 3.8°F), and therefore more suitable. Overall, during the year-round green sturgeon juvenile rearing life stage, the CEQA Yuba Accord

Alternative relative to the CEQA Existing Condition would result in 30 decreases below the 66°F index value (Appendix F4, 3 vs. 1, pgs. 347 through 358).

The juvenile emigration life stage generally extends from May through September. Similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juvenile emigration. As described in the discussion of the year-round juvenile rearing period, during the warmest months of June, July and August water temperatures under the CEQA Yuba Accord Alternative would be substantially lower, and therefore potentially more suitable, under relatively warm water temperature conditions, and overall would result in 30 decreases below the 66°F index value during the juvenile emigration life stage (Appendix F4, 3 vs. 1, pgs. 199 through 210, 248 through 259, and 371 through 382).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding, adult spawning and embryo incubation conditions, because of corresponding upstream migration and spawning flow-related habitat availabilities, and lower and therefore more suitable water temperatures during adult immigration and holding
- Generally equivalent or improved over-summer rearing and juvenile emigration conditions, due to consistently and substantially lower, and therefore potentially more suitable, water temperatures during relatively warm water temperature conditions (generally the warmest 25 percent of water temperature conditions) at Marysville

In conclusion, in consideration of potential impacts to all life stages of green sturgeon, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Yuba River green sturgeon.

Impact 10.2.5-7: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect American shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Yuba River. Studies conducted on the lower Yuba River suggest that shifting of proportional flows (lower Yuba River flows/lower Feather River flows) may simply re-allocate shad from the Feather River to the lower Yuba River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for American shad attraction into the lower Yuba River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.1 percent higher during April, 0.2 percent lower during May, and 1.1 percent higher during June under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Under the CEQA Yuba Accord Alternative, during wet years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.3 percent lower during April, 0.1 percent lower during May, and 0.1 percent lower during June. During above normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.2 percent lower during April, 0.1 percent higher during May, and 2.9 percent higher during June. During below normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.4 percent lower during April, 2.9 percent lower during May, and 0.6 percent lower during June. During dry years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 1.5 percent higher during April, 1.9 percent lower during May, and 1.9 percent higher during June. During critical years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 6.1 percent higher during April, 11.7 percent higher during May, and 8.1 percent higher during June (Appendix F4, 3 vs. 1, pgs. 100 and 272).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Changes in long-term average proportionate flows and average proportionate flows by water year type would not be of sufficient magnitude to substantively affect American shad attraction into the lower Yuba River.

Differences in water temperature between the Feather and lower Yuba rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in 18 fewer occurrences (for the 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 3 vs. 1, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would result in a less than significant impact to lower Yuba River American shad.

Impact 10.2.5-8: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Yuba River. Striped bass spawning and initial rearing in the lower Yuba River extends from April through June. Proportionate flow changes resulting from implementation of the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Yuba River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Changes in long-term average proportionate flows and average proportionate flows by water year type would not be of sufficient magnitude to substantively affect striped bass attraction into and initial rearing in the lower Yuba River.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 6 fewer occurrences (for the 213 months included in the analysis) when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 3 vs. 1, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would result in a less than significant impact to lower Yuba River striped bass.

10.2.5.2 CVP/SWP UPSTREAM OF THE DELTA REGION

FEATHER RIVER BASIN

Oroville Reservoir

Impact 10.2.5-9: Decreases in Oroville Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Reductions in simulated end-of-month water surface elevation in Oroville Reservoir by more than six feet would occur the same number of times during March and April, one fewer time each during May and June under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition. Reduction in the frequency of potential nest dewatering events would be expected to result in increased nest success and contribute to self-sustaining warmwater fish populations. Therefore, changes in water surface elevations that could occur under the CEQA Yuba Accord Alternative would result in a less than significant impact and may be beneficial to Oroville Reservoir warmwater fisheries, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 456 through 467).

Impact 10.2.5-10: Decreases in Oroville Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Under the CEQA Yuba Accord Alternative, long-term average end of month storage would be essentially equivalent from April through November, relative to the CEQA Existing Condition. Average end of month storage by water year type would be essentially equivalent for all months of the April through November period, for all water year types with the exception of June (1.0 percent higher) during above normal, dry and critical years, and May (1.0 percent higher) during critical years. These potential increases in coldwater pool storage would not be of sufficient magnitude to affect Oroville Reservoir's coldwater fisheries because: (1) coldwater habitat availability would be essentially equivalent in the reservoir during all months of the CEQA Yuba Accord Alternative; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal increases in storage would not be expected to affect the primary prey species utilized by coldwater fish. Therefore, changes in reservoir storage that could occur under the CEQA Yuba Accord Alternative would result in a less than significant impact and may be beneficial to Oroville Reservoir coldwater fisheries, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 406).

Lower Feather River

The following sections describe and discuss flow and water temperature differences between the CEQA Yuba Accord Alternative and the CEQA Existing Condition, and potential effects on fisheries and aquatic resources in the lower Feather River.

Over the entire simulation period for every month of the year, long-term average flows and water temperatures for all water year types, monthly mean flows and water temperatures, and the cumulative flow and water temperature distributions in the Low Flow Channel below the Fish Barrier Dam would be essentially equivalent under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Therefore, evaluations of potential effects in the lower Feather River are restricted to below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River (Appendix F4, 3 vs. 1, pgs. 505 through 517 and 554 through 566).

Impact 10.2.5-11: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The analytical period for adult immigration and holding of spring-run Chinook salmon in the lower Feather River extends from March through October. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would be higher by ten percent or more with about 2 percent probability during March and April, and about 10 percent probability during July. Simulated flows would be lower by ten percent or more with about 1 percent probability during March, with about 5 percent probability during April and May, and with 15 percent probability during June. Simulated flows below the Thermalito Afterbay Outlet would be essentially equivalent or measurably higher with a 60 to 90 percent probability during all months of this life stage with the exception of June. During June, flow decreases consistently would occur across most of the cumulative flow distribution, but would remain above about 1,500 cfs with approximately 90 percent probability, and above 3,000 cfs with nearly 70 percent probability. During relatively low flow conditions, flows would be higher by ten percent or more with about 8 percent probability during March and April, and 48 percent probability during July. By contrast, during relatively low flow conditions flows would be lower by ten percent or more with about 4 percent probability during May and 48 percent probability during June (Appendix F4, 3 vs. 1, pgs. 604 through 615 and 628 through 639)

Simulated flows at the mouth of the lower Feather River under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would be higher by ten percent or more with about 2 percent probability during March, April, and September, and with about 10 percent probability during July. Simulated flows would be lower by ten percent or more with about 1 percent probability during March, with about 5 percent probability during April and May, and with 15 percent probability during June. Simulated flows would be essentially equivalent or measurably higher with about 65 to 75 percent probability during all months of this life stage with the exception of May, June, July and August. During May, June, July and August, flow decreases would occur with about 45, 45, 56 and 60 percent probability of exceedance, respectively. During relatively low flow conditions, flows would be higher by ten percent or more with about 4 percent probability during April, June, August and September, 20 percent probability during May, and 36 percent probability during July. By contrast, during relatively low flow conditions flows would be lower by ten percent or more with about 8 percent probability during March (Appendix F4, 3 vs. 1, pgs. 776 through 878 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally equivalent over the entire cumulative water temperature distributions during the March through October adult immigration and holding life stage period. The only relatively minor excursions would occur during June and September, when water temperatures under the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally equivalent with about 95 and 99 percent probability, respectively. Simulated water temperatures would be measurably higher during June and September with about 5 and 1 percent probability, respectively. Under both alternatives, water temperatures would always remain below the 60°F index value during March, and would remain below the 60°F index value with approximately 85 percent probability during April, 56 percent probability during October, with only about a 20 percent probability during May, and always exceed the 60°F index value from June through September. In fact, water temperatures would exceed the 68°F water temperature index value with about 2, 40, 80, 60 and 5 percent probability during May, June, July, August and September, respectively (Appendix F4, 3 vs. 1, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally equivalent or lower over the entire cumulative water temperature distributions during October, March April and May. Infrequent water temperature increases would occur during June, July, August and September; however, water temperatures would be generally equivalent for both alternatives with over 95 percent probability. Simulated water temperatures would be measurably higher under the CEQA Yuba Accord Alternative during June, July August and September with about 1, 6, 4, and 1 percent probability, respectively. Under both alternatives, water temperatures would remain at or below the 60°F index value with approximately 99 percent probability during March, 40 percent probability during April, 20 percent probability during October, with only about a 1 percent probability during May, and would always exceed the 60°F index value from June through September. In fact, under both alternatives, water temperatures would exceed the 68°F water temperature index value with about 20, 70 and 85 percent probability during May, June and September, respectively. Water temperatures would always exceed 68°F during July and August (Appendix F4, 3 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire March through October adult immigration and holding period below the Thermalito Afterbay Outlet, no additional increases above, or decreases below the 60ºF, 64ºF or 68°F index values would occur under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 678 through 689). At the mouth of the Feather River, the CEQA Yuba Accord Alternative would result in 1 increase above the 60°F index value, and 2 decreases below the 68°F index value, relative to the CEQA Existing Condition. No increases above, or decreases below the 64°F index values would occur the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 825 through 836).

Because no clear distinction between spring- and fall-run Chinook salmon spawning could be derived from survey data collected in the lower Feather River, the spawning habitat analysis for potential impacts on the two runs was combined into one expanded spawning season (September through December) that was inclusive of all Chinook salmon spawning in the lower Feather River. Over the 71-year simulation period, the annual spawning habitat availability long-term average for Chinook salmon spawning in the lower Feather River under the CEQA Yuba Accord Alternative would be similar to that under the CEQA Existing Condition (long-term average of 85.6 percent versus 85.7 percent of the maximum WUA) (Appendix F4, 3 vs. 1, pg. 873).

The cumulative annual Chinook salmon spawning habitat availabilities under the CEQA Yuba Accord Alternative would be almost undistinguishable from those under the CEQA Existing Condition. Both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would achieve over 90 percent of maximum WUA with about 30 percent probability, and both alternatives would achieve over 80 percent of maximum WUA with nearly 85 percent probability. Changes of 10 percent or more in annual spawning habitat availability would not occur (Appendix F4, 3 vs. 1, pg. 875).

Water temperatures below the Thermalito Afterbay Outlet during September, which represents the earliest month of the spawning period, would be nearly identical between the CEQA Yuba Accord Alternative and the CEQA Existing Condition, and commonly would exceed water temperatures reported to be suitable for Chinook salmon spawning. For example, under both alternatives, water temperatures below the Thermalito Afterbay Outlet during September would exceed 62°F about 95 percent of the time. Water temperatures under both alternatives also would be essentially equivalent during October, November and December. Under both alternatives during October, water temperatures would exceed the reported optimum (56°F) for Chinook salmon spawning about 95 percent of the time, whereas water temperatures would remain suitable for spawning during November and December (Appendix F4, 3 vs. 1, pgs. 678 through 689 and 702 through 713).

The embryo incubation life stage for Chinook salmon in the lower Feather River generally extends from September through February. Timing of fry emergence is primarily dependant on water temperature. As indicated above for the spawning life stage, water temperatures below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be nearly identical to those under the CEQA Existing Condition during the September through December period. During January and February, water temperatures generally would not exceed 53°F, and therefore would not approach the lowest water temperature index value (56°F) below the Thermalito Afterbay Outlet under either the CEQA Yuba Accord Alternative or the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 678 through 689 and 702 through 713).

Long-term average early life stage survival estimates would be identical under the CEQA Yuba Accord Alternative and the CEQA Existing Condition (97.7 percent). Early life stage survival estimates would not differ by more than 0.4 percent for any individual year included in the 71-year period of analysis. Substantial reductions in salmon survival over three or more consecutive years are not observed between the CEQA Yuba Accord Alternative and the CEQA Existing Condition. Therefore, the CEQA Yuba Accord Alternative would not be anticipated to affect potential future recruitment from a given spawning stock, which may in turn affect the population dynamics of subsequent generations (Appendix F4, 3 vs. 1, pg. 881).

Spring-run Chinook salmon juveniles are commonly reported to rear in their natal streams from 9 to 18 months. Specific habitat-discharge relationships for juvenile Chinook salmon rearing have not been developed for the lower Feather River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to Chinook salmon juveniles. Therefore, for impact assessment purposes, year-round examination of water temperatures is conducted to address potential juvenile spring-run Chinook salmon rearing in the lower Feather River.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be nearly identical to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. From November through April, water temperatures generally would remain below 60°F under both alternatives. Water temperatures during May would remain at or below 65°F about 90 percent of the time, whereas during June water temperatures would exceed 65°F about 75 percent of the time, would always exceed 65°F during July and August, and would exceed 65°F during September nearly 50 percent of the time. Water temperatures are considered to be particularly stressful to rearing juvenile Chinook salmon during July and August, when water temperatures under both alternatives would exceed about 70°F with nearly 40 and 75 percent probability, respectively. Overall, during the year-round juvenile Chinook salmon rearing life stage below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in one decrease below the 60°F index value, 1 increase above the 65°F index value, and 1 decrease below the 68°F index value. No additional increases above, or decreases below the 63, 70 and 75°F index values would occur under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 678 through 689 and 702 through 713).

Spring-run Chinook salmon smolt emigration reportedly occurs from October through June. Flows below the Thermalito Afterbay Outlet from October through March would be essentially equivalent or measurably higher over 70 percent of the cumulative flow distributions under the CEQA Yuba Accord Alternative and the CEQA Existing Condition. During April and May, flows would be essentially equivalent or measurably higher about 65 percent of the cumulative flow distribution. Measurable flow decreases would occur at intermediate flow levels during April and May. These flow reductions at the intermediate to high flow levels would not be expected to substantively affect spring-run Chinook salmon smolt emigration habitat conditions. During June, measurable flow decreases consistently would occur across about half of the cumulative flow distributions, but would remain above 1,500 cfs with about 90 percent probability and above 3,000 cfs with approximately 70 percent probability (Appendix F4, 3 vs. 1, pgs. 604 through 615 and 628 through 639).

Simulated flows below the Thermalito Afterbay Outlet would not change by ten percent or more with more than about 5 percent probability during any month of the smolt emigration life stage, with the exception of June. During June, flows under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would be lower by ten percent or more with about a 15 percent probability. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 4 percent probability during December and February, and 8 percent probability during March and April. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with 4 percent probability during May and 48 percent probability during June (Appendix F4, 3 vs. 1, pgs. 604 through 615 and 628 through 639).

Flows at the mouth of the lower Feather River would be measurably higher over more than 40 percent of the cumulative flow distribution from October through December under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Flows during January, March and April would be essentially equivalent or measurably higher with about 60 to 70 percent probability, and would be measurably lower with about 25 to 35 percent probability. Flows during February would be essentially equivalent or measurably higher over 80 percent of the cumulative flow distribution. Measurable flow decreases would occur with approximately a 45 percent probability during May and June. However, flows would remain above 1,500 cfs under both alternatives with about 95 percent probability during May, and over the entire cumulative distribution during June. Flows would remain above 3,000 cfs with approximately 70 and 85 percent probability during May and June, respectively (Appendix F4, 3 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated flows at the mouth of the Feather River would not change by ten percent or more with more than about 5 percent probability during any month of the smolt emigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 4 percent probability during December, April and June, a 20 percent probability during January and May, and a 16 percent probability during February. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with 8 percent probability during January and March (Appendix F4, 3 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally equivalent over the entire cumulative water temperature distributions during the October through June smolt emigration life stage period. The only relatively minor excursion would be during the month of June, when water temperatures under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would be generally equivalent with about 95 percent probability and would be measurably higher with nearly 5 percent probability. Under both alternatives, water temperatures would always remain below the 60°F index value from November through March, with nearly a 60 and 90 percent probability during October and April, respectively, with only about a 15 percent probability during May, and would always exceed the 60°F index value during June (Appendix F4, 3 vs. 1, pgs. 678 through 689 and 702 through 713).

At the mouth of the lower Feather River, water temperatures under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally below 60°F from November through March. Under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, water temperatures would be generally measurably equivalent or lower during October, April and June. During May, water temperatures would be essentially equivalent or measurably lower with approximately 98 percent probability, and would be measurably higher with approximately 2 percent probability. During May under warm water temperature conditions, water temperatures would be measurably lower with approximately 36 percent probability, and would be measurably higher with approximately 8 percent probability (Appendix F4, 3 vs. 1, pgs. 825 through 836).

Overall, during the entire October through June smolt emigration period below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 decrease below the 63°F index value. No increases above or decreases below the 60ºF, 68ºF or 70°F index values would occur under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. At the mouth of the Feather River, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in 1 increase above the 60°F index value, 2 decreases below the 68°F index value, and 2 decreases below the 68°F index value. No increases above, or decreases below the 63°F index values would occur under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 825 through 836).

Based on instream flow, water temperature, spawning habitat availability and early life stage survival analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent adult immigration and holding conditions due to: (1) equivalent or measurably higher flows occurring with 60 to 90 percent probability during all months of this life stage below the Thermalito Afterbay Outlet with the exception of June; (2) during June below the Thermalito Afterbay Outlet, flow decreases would occur across most of the cumulative flow distribution, but would remain above about 1,500 cfs with about 90 percent probability, and above 3,000 cfs with more than 70 percent probability; (3) equivalent or measurably higher flows ranging from 65 percent to 75 percent of the time during October, March, April and September at the mouth of the lower Feather River; (4) during May through August, flow decreases would occur from 45 to 60 percent probability, but remain above about 1,500 cfs with about 95 to 100 percent probability, and above 3,000 cfs with about 70 to 90 percent probability at the mouth of the lower Feather River; and (5) generally equivalent water temperatures at the mouth of the lower Feather River with over 95 percent probability during the adult immigration and holding period

- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period

- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates

- Equivalent over-summer juvenile rearing conditions due to nearly identical water temperatures below the Thermalito Afterbay Outlet

- Generally equivalent smolt emigration conditions due to: (1) generally equivalent flows from December through March; (2) reduced flows during intermediate flow levels (generally at or above 1,500 cfs) during October, November, April and May, which would not be expected to substantively affect smolt emigration conditions below the Thermalito Afterbay Outlet; (3) measurable flow decreases during June, which may not substantively affect spring-run Chinook salmon smolt emigration because this flow pattern may accommodate the emigration of juvenile spring-run Chinook salmon before warm water temperatures occur during late spring in drier water years in the lower portion of the lower Feather River (additionally, in the Feather River, data on juvenile Chinook salmon emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run Chinook salmon emigration (DWR and Reclamation 1999; Painter *et al.* 1977)); and (4) generally equivalent water temperature conditions during this life stage, with lower and therefore more suitable water temperatures during 10 percent of the warmest water temperature conditions during May

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River spring-run Chinook salmon.

Impact 10.2.5-12: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The adult immigration and holding life stage for fall-run Chinook salmon in the lower Yuba River primarily extends from July through December. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would be higher by ten percent or more with nearly 10, 1 and 4 percent probability during July, September and December, respectively. Simulated flows would not be lower by ten percent or more during any month of the fall-run Chinook salmon adult immigration and holding life stage. Simulated flows below the Thermalito Afterbay Outlet would be essentially equivalent or measurably higher with a 70 to 95 percent probability during all months of this life stage. During relatively low flow conditions, flows would be higher by ten percent or more with about 48 percent probability during July and 4 percent probability during December (Appendix F4, 3 vs. 1, pgs. 628 through 639).

Under the CEQA Yuba Accord Alternative, simulated flows at the mouth of the lower Feather River would be higher than the CEQA Existing Condition by ten percent or more with nearly 10 percent probability during July, 1 percent probability during August and September and 4 percent probability during December. Simulated flows would be lower by ten percent or more with about 1 percent probability during December. Simulated flows would be measurably higher with about 40 to 55 percent probability during October, November and December. In September, simulated flows would be measurably higher or essentially equivalent with about 65 percent probability, and measurably lower with approximately 35 percent probability. Simulated flows would be measurably lower with about 55 to 60 percent probability during July and August; however flows would be higher than 1,500 cfs with about 98 percent probability, and higher than 3,000 cfs with about 80 to 90 percent probability. During relatively low flow conditions, flows would be higher by ten percent or more with about 36 percent probability during July, and 4 percent probability during August, September and December (Appendix F4, 3 vs. 1, pgs. 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet would be generally equivalent for the CEQA Yuba Accord Alternative and the CEQA Existing Condition over the entire cumulative water temperature distributions during the July through December adult immigration and holding life stage period (Appendix F4, 3 vs. 1, pgs. 702 through 713).

Water temperatures at the mouth of the Feather River under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally equivalent or lower over the entire cumulative water temperature distributions during October and November. The CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in infrequent increases in water temperature during December and September; however, water temperatures would be generally equivalent under both alternatives with over 95 percent probability. During July and August, simulated water temperatures would be measurably lower with less than 5 percent probability, and measurably higher also with less than 5 percent probability. Under both alternatives, water temperatures would always remain below the 60°F during November and December, and would remain below 60ºF with approximately a 20 percent probability during October. Simulated water temperatures would always exceed 60°F during July through September. In fact, under both alternatives, water temperatures would always exceed the 68°F water temperature index value during July and August, and would exceed 68ºF with about 85 percent probability during September (Appendix F4, 3 vs. 1, pgs. 825 through 836).

Overall, during the entire July thorough December adult immigration and holding period below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River, no additional increases above, or decreases below the 60ºF, 64ºF or 68°F index values would occur under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix G, 3 vs. 1, pgs. G-127 through G-128).

The adult spawning and embryo incubation life stage periodicities of fall-run Chinook salmon in the Feather River are not distinguished from those of the spring-run; therefore these life stages are not evaluated separately. For evaluation of Chinook salmon spawning and embryo incubation under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, see the discussion provided above under spring-run Chinook salmon.

The juvenile fall-run Chinook salmon rearing and outmigration period in the lower Feather River extends from November through June. Flows below the Thermalito Afterbay Outlet from November through May would be essentially equivalent or measurably higher with 65 to 90 percent probability under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. During June, measurable flow decreases would occur over about half of the cumulative flow distributions, but would remain above 1,500 cfs with about 90 percent probability and above 3,000 cfs with approximately 70 percent probability (Appendix F4, 3 vs. 1, pgs. 628 through 639).

For the entire cumulative flow distribution, simulated flows below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would not change by ten percent or more with more than about 5 percent probability during any month of the smolt emigration life stage, with the exception of June. During June, flows would be lower by ten percent or more with about a 15 percent probability. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 4 percent probability during December and February, and 8 percent probability during March and April. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with 4 percent probability during May and 48 percent probability during June (Appendix F4, 3 vs. 1, pgs. 628 through 639).

Flows at the mouth of the lower Feather River would be measurably higher with a 50 percent or more probability during November and December under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Flows from January, through April would be essentially equivalent or measurably higher with about 65 to 85 percent probability. Flows during May and June would be essentially equivalent or measurably higher with about 50 to 55 percent probability, and measurable lower with about 45 percent probability. However, flows would remain above 1,500 cfs under both alternatives with about 95 percent probability during May, and over the entire cumulative distribution during June. Flows would remain above 3,000 cfs with approximately 70 and 85 percent probability during May and June, respectively (Appendix F4, 3 vs. 1, pgs. 800 through 811).

For the entire cumulative flow distribution, simulated flows at the mouth of the Feather River would not change by ten percent or more with more than 10 percent probability during any month of the juvenile rearing and outmigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 4 percent probability during December, April and June, 20 percent during January and May, and 16 percent during February. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with 8 percent probability during January and March (Appendix F4, 3 vs. 1, pgs. 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally equivalent over the entire cumulative water temperature distributions during the November through May juvenile rearing and outmigration life stage period. Infrequent water temperatures increases would occur during the month of June; however water temperatures would be generally equivalent with about 95 percent probability and are measurably higher with nearly 5 percent probability. Under both alternatives, water temperatures would always remain below the 60°F index value from November through March, with nearly 90 percent probability during April and with only about 15 percent probability during May. Water temperatures would always exceed the 60°F index value during June (Appendix F4, 3 vs. 1, pgs. 702 through 713).

At the mouth of the lower Feather River, water temperatures under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would generally remain below 60°F from November through March. Under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, water temperatures would be generally equivalent or lower during April and June. During May, water temperatures would be essentially equivalent or measurably lower with approximately 98 percent probability, and would be measurably higher with approximately 2 percent probability. During warmer conditions, water temperatures would be measurably lower with approximately 36 percent probability, and would be measurably higher with approximately 8 percent probability (Appendix F4, 3 vs. 1, pgs. 849 through 860).

Overall, during the entire November through June juvenile rearing and outmigration period below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, would result in 1 decrease below the 63°F index value, and 1 increase above the 65°F index value. No increases above or decreases below the 60ºF, 68ºF or 70°F index values would occur under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 678 through 689). At the mouth of the Feather River, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in 1 increase above the 60°F index value and 2 decreases below the 68°F index value. No increases above or decreases below the 63°F, 65°F or 70°F index values would occur under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 825 through 836).

Based on instream flow, water temperature, spawning habitat availability and early life stage survival analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent adult immigration and holding conditions due to: (1) equivalent or measurably higher flows with about 70 to 95 percent probability during all months of this life stage below the Thermalito Afterbay Outlet; (2) higher flows during the lowest 30 percent of flows during July below the Thermalito Afterbay Outlet; (3) generally equivalent flow conditions at the mouth of the lower Feather River over this life stage; and (4) generally equivalent water temperatures over the entire cumulative water temperature distributions during July through December below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River
- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period
- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates
- Generally equivalent juvenile rearing and outmigration conditions due to: (1) generally equivalent flows from December through March; (2) reduced flows during intermediate flow levels (generally at or above 1,500 cfs) during November, April and May, which would not be expected to substantively affect juvenile rearing and outmigration conditions below the Thermalito Afterbay Outlet; (3) measurable flow decreases during June, which may not substantively affect fall-run Chinook salmon juvenile rearing and outmigration because this flow pattern may accommodate the emigration of juvenile fall-run Chinook salmon before warm water temperatures occur during late spring in

drier water years in the lower portion of the lower Feather River; and (4) generally equivalent water temperature conditions during this life stage, with lower and therefore more suitable water temperatures during 10 percent of the warmest water temperature conditions during May

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River fall-run Chinook salmon.

Impact 10.2.5-13: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the lower Feather River extends from August through April. Simulated flows below the Thermalito Afterbay Outlet would be higher by ten percent or more with about 2 percent probability during September, March and April, and 1 percent during December and February. Simulated flows would be lower by ten percent or more with about 2 percent probability during January, 1 percent probability during March, and 5 percent probability during April. Simulated flows would be essentially equivalent or measurably higher with a 60 to 95 percent probability during all months of this life stage. During relatively low flow conditions, flows would be higher by ten percent or more with about 4 percent probability during December and February, and 8 percent probability during March and April (Appendix F4, 3 vs. 1, pgs. 628 through 639).

Simulated flows at the mouth of the lower Feather River would be higher by ten percent or more with about 1 percent probability during August, September and April, 4 percent probability during December and February, and 5 percent probability during January. Simulated flows would be lower by ten percent or more with about a 1 percent probability during December, and a 2 percent probability during January, February and March. Simulated flows would be measurably higher with about a 40 to 55 percent probability from October through December. Simulated flows would be essentially equivalent or measurably higher with a 60 to 85 percent probability during January through April. During August, flows would be measurably lower with about a 60 percent probability. However, flows would remain above 1,500 cfs under both alternatives with over 95 percent probability. During August, flows would remain above 3,000 cfs with approximately 80 percent probability. During relatively low flow conditions, flows would be higher by ten percent or more with about 4 percent probability during August, September, December and April, 8 percent probability during January, and 16 percent probability during February. Flows would be lower by ten percent or more during relatively low flow conditions with about 8 percent probability during March (Appendix F4, 3 vs. 1, pgs. 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally equivalent over the entire cumulative water temperature distributions during the August through April adult immigration and holding life stage period. Under both alternatives, water temperatures would always remain below the 56°F index value from December through February, and would remain below the 56°F index value with approximately 95 percent probability during November, 90 percent probability during March, 30 percent probability during April, with only about a 3 percent probability during October, and always exceed the 56°F index value during August and September. In fact, water temperatures under both alternatives would exceed the 70°F index value with about 35 and 1 percent probability during August and September, respectively (Appendix F4, 3 vs. 1, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally equivalent over the entire cumulative water temperature distributions for all of the months comprising the adult immigration and holding life stage. Infrequent water temperature increases would occur during December, August and September; however, water temperatures would be generally equivalent for the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, with about 95 to 99 percent probability. Simulated water temperatures would be measurably higher during December, August and September with about 5, 5, and 1 percent probability, respectively. Under both alternatives, water temperatures would always remain at or below the 56°F index value from November through February. Water temperatures would remain at or below the 56°F index value with approximately 90 percent probability during March, with only 2 percent probability during April, and would always exceed the 56°F index value during August through October. In fact, water temperatures under both alternatives would exceed the 70°F index value with about 70 and 55 percent probability during August and September, respectively (Appendix F4, 3 vs. 1, pgs. 849 through 860 and 825 through 836).

Overall, during the entire August through April adult immigration and holding period below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in no increases above or decreases below the 52°F, 56°F or 70°F index values (Appendix F4, 3 vs. 1, pgs. 678 through 689). At the mouth of the Feather River, the CEQA Yuba Accord Alternative would result in no increases above or decreases below the 52°F or 56°F index values, and 1 decrease below the 70°F index value (Appendix F4, 3 vs. 1, pgs. 825 through 836 and Appendix G, 3 vs. 1, pg. 128).

The primary analytical period for steelhead spawning extends from December through March. Over the 72-year simulation period, the annual spawning habitat availability long-term average for steelhead in the lower Feather River under the CEQA Yuba Accord Alternative would be 0.3 percent higher than under the CEQA Existing Condition (long-term average of 55.4 versus 55.1 percent of the maximum WUA) (Appendix F4, 3 vs. 1, pg. 876).

The cumulative annual steelhead spawning habitat availabilities under the CEQA Yuba Accord Alternative would be almost undistinguishable from those under the CEQA Existing Condition. Both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would achieve over 90 percent of maximum WUA with about 11 percent probability. Changes of 10 percent or more in annual spawning habitat availability would not occur (Appendix F4, 3 vs. 1, pg. 878).

Under the CEQA Yuba Accord Alternative, water temperatures below the Thermalito Afterbay Outlet during the December through March steelhead spawning period would be essentially equivalent to water temperatures under the CEQA Existing Condition. Water temperatures below the Thermalito Afterbay Outlet during the December through May embryo incubation period also would be essentially equivalent to water temperatures under the CEQA Existing Condition. Overall, during the entire December through May steelhead adult spawning and embryo incubation period, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in no increases above or decreases below the 52°F, 54°F, 57°F or 60°F index values (Appendix F4, 3 vs. 1, pgs. 678 through 689).

Steelhead are commonly reported to rear in their natal streams year round for up to two years. Specific habitat-discharge relationships for juvenile steelhead rearing have not been developed for the lower Feather River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles. Therefore, for impact assessment purposes, year-round examination of water temperatures is conducted to address potential impacts to juvenile steelhead rearing in the lower Feather River.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be generally essentially equivalent to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. From October through April, water temperatures generally would remain below 65°F under both alternatives. Water temperatures during May would remain at or below 65°F with about 90 percent probability, whereas during June water temperatures would exceed 65°F with about 75 percent probability, would always exceed 65°F during July and August, and would exceed 65°F during September nearly 50 percent of the time. Water temperatures are considered to be particularly stressful to rearing steelhead during July and August, when water temperatures under both alternatives would exceed about 72°F with nearly 10 percent probability. Overall, during the year-round juvenile steelhead rearing life stage below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative would result in one increase above the 65°F index value. No increases above or decreases below the 68°F, 72°F or 75°F index values would occur under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 678 through 689 and 702 through 713).

Steelhead smolt emigration reportedly occurs from October through May. Flows below the Thermalito Afterbay Outlet from October through March would be essentially equivalent or measurably higher over 70 percent of the cumulative flow distributions under the CEQA Yuba Accord Alternative and the CEQA Existing Condition. During April and May, flows would be essentially equivalent or measurably higher about 65 percent of the cumulative flow distribution. Measurable flow decreases would occur at intermediate flow levels during April and May. These flow reductions at the intermediate to high flow levels would not be expected to substantively affect steelhead smolt emigration habitat conditions (Appendix F4, 3 vs. 1, pgs. 604 through 615 and 628 through 639).

Simulated flows below the Thermalito Afterbay Outlet would not change by ten percent or more with more than about 5 percent probability during any month of the smolt emigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 4 percent probability during December and February, and an 8 percent probability during March and April. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with about a 4 percent probability during May (Appendix F4, 3 vs. 1, pgs. 604 through 615 and 628 through 639).

Flows at the mouth of the lower Feather River would be measurably higher over more than 40 percent of the cumulative flow distribution from October through December under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Flows during January, March and April would be essentially equivalent or measurably higher with about 60 to 70 percent probability, and would be measurably lower with about 25 to 35 percent probability. Flows during February would be essentially equivalent or measurably higher over 80 percent of the cumulative flow distribution. Measurable flow decreases occur with approximately a 45 percent probability during May; however, flows would remain above 1,500 cfs under both alternatives with about 95 percent probability. Flows during May would remain above 3,000 cfs with approximately 70 percent probability (Appendix F4, 3 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated flows at the mouth of the Feather River would not change by ten percent or more with more than about 5 percent probability during any month of the smolt emigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 4 percent probability during December and April, a 20 percent during January and May and a 16 percent during February. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with an 8 percent probability during January and March (Appendix F4, 3 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally equivalent over the entire cumulative water temperature distributions during the October through May smolt emigration life stage period. Under both alternatives, water temperatures would always remain below the 52°F index value during December and January, and would remain below the 52°F index value with nearly a 90 percent probability during February, a 30 percent probability during October, November and March, and with only about a 2 percent probability during April, and would always exceed the 52°F index value during May (Appendix F4, 3 vs.1, pgs. 702 through 713 and 678 through 689).

At the mouth of the lower Feather River, water temperatures under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would generally remain below 52°F during December and January. Under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, water temperatures would be generally equivalent or lower during every month of the steelhead smolt emigration life stage period, except for December. During December, water temperatures would be essentially equivalent with approximately 97 percent probability, and would be measurably higher with approximately 3 percent probability. Moreover, as previously discussed, water temperatures during December would remain below 52°F. During warm water temperature conditions, water temperatures are measurably lower with approximately an 8 percent probability during March and about a 36 percent probability during May. By contrast, water temperatures during warm water temperature conditions would be measurably higher with approximately an 8 percent probability during May (Appendix F4, 3 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire October through May steelhead smolt emigration period below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, would not result in increases above or decreases below the 52°F, 55°F or 59°F index values (Appendix F4, 3 vs. 1, pgs. 678 through 689). At the mouth of the Feather River, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in 1 and 2 increases above the 55°F and 59°F index value, respectively (Appendix F4, 3 vs. 1, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent adult immigration and holding conditions due to: (1) equivalent or measurably higher flows ranging from 60 percent to 95 percent of the time during all months of this life stage below the Thermalito Afterbay Outlet; (2) equivalent or measurably higher flows with about 60 to 85 percent probability during September through April at the mouth of the lower Feather River; (3) measurable flow decreases during August, yet flows would almost always remain above about 2,000 cfs at the mouth of the lower Feather River; and (4) simulated water temperatures would be generally equivalent over the entire cumulative water temperature distributions during the August through April below the Thermalito Afterbay Outlet and at the mouth of the Feather River

- Equivalent spawning conditions due to similar spawning habitat availability during the December through April adult spawning period
- Equivalent juvenile rearing conditions due to essentially equivalent water temperatures below the Thermalito Afterbay Outlet
- Generally equivalent smolt emigration conditions due to: (1) generally equivalent flow and water temperature conditions below the Thermalito Afterbay Outlet, with the exception of flow reductions primarily occurring during April and May at intermediate flow levels, which would not be expected to substantively affect steelhead smolt emigration habitat conditions; and (2) generally equivalent water temperatures from October through April, with lower water temperatures during 10 percent of the warmest water temperature conditions during May at the mouth of the Feather River

In conclusion, in consideration of potential impacts to all life stages of steelhead, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River steelhead.

Impact 10.2.5-14: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect green sturgeon

The analytical period for green sturgeon adult immigration and holding extends from February through July. Under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, simulated flows below the Thermalito Afterbay Outlet would be essentially equivalent or measurably higher with 65 to 90 percent probability during all months of this life stage except for June. During June, simulated flows would be measurably lower with about 65 percent probability; however, flows would remain above 1,500 cfs about 90 percent of the time, and above 3,000 cfs about 70 percent of the time (Appendix F4, 3 vs. 1, pgs. 604 through 615).

Under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, simulated flows at Shanghai Bench would be essentially equivalent or measurably higher with 60 to 80 percent probability for March and February, respectively. Simulated flows would be essentially equivalent or higher with 50 percent probability and measurably lower also with 50 percent probability during April, May and June. During July, simulated flows would be measurably lower with about 60 percent probability; however, flows would remain above 1,500 cfs during the entire cumulative flow distribution, and above 3,000 cfs about 95 percent of the time (Appendix F4, 3 vs. 1, pgs. 727 through 738 and 751 through 762).

Under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, simulated flows at the mouth of the lower Feather River would be essentially equivalent or measurably higher with 60 to 80 percent probability during February through April. Simulated flows would be essentially equivalent or higher with 55 percent probability and measurably lower with 45 percent probability during May and June. During July, simulated flows would be measurably lower with about 55 percent probability; however, flows would remain above 1,500 cfs with approximately 95 percent probability, and above 3,000 cfs about 90 percent of the time (Appendix F4, 3 vs. 1, pgs. 776 through 787 and 800 through 811).

Because the analytical period for green sturgeon spawning (i.e., March through July) falls within the adult immigration and holding analytical period, flows under the CEQA Yuba

Accord Alternative, relative to the CEQA Existing Condition also would be expected to provide similar conditions for the spawning life stage.

Relative to the CEQA Existing Condition, water temperatures under the CEQA Yuba Accord Alternative would be expected to provide similar conditions during the adult immigration and holding, spawning, and embryo incubation life stages. Infrequent water temperatures increases would occur during June; however water temperatures would be generally equivalent with about 95 percent probability and would be measurably higher with nearly 5 percent probability. During the adult immigration and holding life stage at the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative would result in one increase above the 61°F index value. No increases above or decreases below the 61°F index values would occur at the mouth of the lower Feather River. During the adult spawning and embryo incubation life stages, which occur at the Thermalito Afterbay Outlet but not at the mouth of the Feather River, the CEQA Yuba Accord Alternative would not result in any increases above or decreases below the 68°F index value (Appendix F4, 3 vs. 1, pgs. 678 through 689 and 825 through 836).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Year-round flows below Thermalito Afterbay and at the mouth of the lower Feather River have been generally described above under the spring-run Chinook salmon, fall-run Chinook salmon, and steelhead life stage evaluations. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Feather River. However, NMFS (2005) states that the main factor for the decline of the southern DPS of green sturgeon is not rearing habitat availability, but the reduction of green sturgeon spawning area in the Sacramento and Feather rivers. Moreover, available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juveniles.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative would be generally essentially equivalent to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. From October through April, water temperatures generally would remain below 66°F under both alternatives. Water temperatures during May would remain at or below 66°F about 95 percent of the time, whereas during June, August and September, water temperatures would exceed 66°F with about a 65, 95 and 25 percent probability, respectively. Water temperatures would always exceed 66°F during July. Overall, during the year-round juvenile green sturgeon rearing life stage below the Thermalito Afterbay Outlet, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in one increase above the 66°F index value (Appendix F4, 3 vs. 1, pgs. 702 through 713).

Simulated water temperature conditions at the mouth of the lower Feather River under the CEQA Yuba Accord Alternative would generally be essentially equivalent to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. From October through April, water temperatures generally would remain below 66°F under both alternatives. Water temperatures during May and June would remain at or below 66°F with about a 45 and 10 percent probability, respectively. Water temperatures would always exceed 66°F during July, August and September. Overall, increases above or decreases below the 66°F index value would not occur under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition.

The juvenile emigration life stage generally extends from May through September. Trends in flows during this life stage are encompassed in the description above for spring-run Chinook salmon adult immigration and holding. Also, similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juvenile emigration. Simulated water temperature conditions below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River under the CEQA Yuba Accord Alternative would be generally essentially equivalent to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the juvenile emigration period. Overall, the CEQA Yuba Accord Alternative would result in one increase above the 66ºF index value below the Thermalito Afterbay Outlet, and no increases above, or decreases below the 66°F index value below the and at the mouth of the lower Feather River.

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to provide:

- Generally equivalent adult immigration and holding, adult spawning and embryo incubation conditions because of corresponding upstream migration and spawning flow-related habitat availabilities, and generally suitable water temperatures during adult immigration and holding
- Generally equivalent over-summer juvenile rearing and juvenile emigration conditions due to generally equivalent water temperatures

In conclusion, in consideration of potential impacts to all life stages of green sturgeon, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River green sturgeon.

Impact 10.2.5-15: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect American Shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Feather River. As discussed above for lower Yuba River American shad, shifting of proportional flows (lower Feather River flows/Sacramento River flows) may simply re-allocate shad from the Sacramento River to the lower Feather River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for American shad attraction into the lower Feather River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Feather River flow, measured at its mouth, to Sacramento River flow, measured downstream of its confluence with the Feather River, would be 0.2 percent lower during April, 0.3 percent lower during May, and 0.3 percent lower during June under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Under the CEQA Yuba Accord Alternative, during wet years the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.1 percent lower during April and 0.3 percent lower during June, with no change in May. During above normal years the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.2 percent lower during April, 0.2 percent lower during May, and 0.5 percent lower during June. During below normal years the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.8 percent lower during April, 1.1 percent lower during May, and 0.1 percent lower during June. During dry years the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.1 percent lower during April, 1.6 percent lower during May, and 0.3 percent lower during June. During critical years the change in long-term average percentage of lower Feather River flow to Sacramento River flow would be 0.4 percent higher during April, 1.4 percent higher during May, and 0.1 percent higher during June (Appendix F4, 3 vs. 1, pgs. 775 and 882).

American shad adult immigration and spawning would not be expected to be significantly affected by these relatively minor changes in proportionate flows under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition.

Differences in water temperature between the Sacramento and lower Feather rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 3 additional occurrences (for the 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Feather River mouth (Appendix F4, 3 vs. 1, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to provide changes in proportionate lower Feather River to Sacramento River flows, and water temperatures within the reported range of suitable spawning temperatures, that would result in a less than significant impact to American shad.

Impact 10.2.5-16: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Feather River. Striped bass spawning and initial rearing in the lower Feather River extends from April through June. Proportionate flow changes resulting from implementation of the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Feather River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by these relatively minor changes in proportionate flows under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 3 additional occurrences (for the 213 months included in the analysis) when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at Feather River mouth (Appendix F4, 3 vs. 1, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to provide changes in proportionate lower Feather River to Sacramento River flows, and water temperatures within the reported range of suitable spawning and initial rearing water temperatures, that would result in a less than significant impact to striped bass.

Impact 10.2.5-17: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail spawning, embryo incubation, and initial rearing life stages in the lower Feather River occur from February through May. Over the entire 72-year period of simulated February through May estimates of usable flooded area (UFA), long-term average UFA in the lower Feather River would be 0.5 percent lower under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, with average estimates of UFA by water year type ranging from 0.2 percent higher during wet years to 1.7 percent lower during dry years. Changes of 10 percent or more in UFA would not occur over more than 10 percent of the cumulative UFA distributions (Appendix F4, 3 vs. 1, pgs. 879 and 880).

Over the entire 71-year simulation period, February through May monthly mean water temperatures below the Thermalito Afterbay Outlet, under both the CEQA Yuba Accord Alternative and CEQA Existing Condition would remain within the 45 - 75°F range of water temperatures reported to be suitable for splittail spawning (Appendix F4, 3 vs. 1, pgs. 825 through 836).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would expected to provide generally equivalent conditions for Sacramento splittail in the lower Feather River. In conclusion, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in a less than significant impact to Sacramento splittail.

SACRAMENTO RIVER BASIN

Sacramento River

The following sections describe and discuss flow and water temperature differences between the CEQA Yuba Accord Alternative and the CEQA Existing Condition, and potential effects on fisheries and aquatic resources in the Sacramento River immediately downstream of the Feather River confluence and at Freeport.

Model output demonstrates relatively minor and infrequent, but measurable changes in flows the Sacramento River immediately downstream of the Feather River confluence. For example, over the 864 months simulated for the Sacramento River immediately below the Feather River confluence, only two monthly mean flows indicate that a 10 percent or greater change under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition – one decrease of 11.5 percent occur in October, and one increase of 13.6 percent occur in July (Appendix F4, 3 vs. 1, pgs. 883 through 894). The cumulative flow distributions for the CEQA Yuba Accord Alternative and the CEQA Existing Condition demonstrate generally equivalent flows during February, March, April and June, slightly higher flows in October, November and December, slightly lower flows at intermediate flow levels accompanied by slightly higher flows under low flow conditions during January, May, July, September, and slightly lower flows during low and intermediate flow levels during August (Appendix F4, 3 vs. 1, pgs. 907 through 918).

Similar results are evident in the Sacramento River at Freeport, with only one monthly mean flow changing 10 percent or more (12.4 percent increase during July) under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 1006 through 1017). The cumulative flow distributions for the CEQA Yuba Accord Alternative and the CEQA Existing Condition at Freeport display generally equivalent flows in October, November, December, January, February, March, April, June and September. During May, July and August, flow slight decreases occur at intermediate to high flow levels, accompanied by slight flow increases under low flow conditions. (Appendix F4, 3 vs. 1, pgs. 1030 through 1041).

Water temperatures in the Sacramento River immediately downstream of the Feather River confluence generally would remain similar under the CEQA Yuba Accord Alternative and the CEQA Existing Condition during most months. In fact, below the Feather River confluence, measurable (> 0.3°F) water temperature increases would rarely occur (10 times out of the 852 months simulated) under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition. The cumulative water temperature distributions for the CEQA Yuba Accord Alternative and the CEQA Existing Condition would be generally equivalent during all months at the lower Feather River confluence and at Freeport. In fact, at Freeport, measurable (> 0.3°F) water temperature increases would rarely occur (1 time out of the 852 months simulated) under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 957 through 968 and 1055 through 1066).

Impact 10.2.5-18: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect winter-run Chinook salmon

The winter-run Chinook salmon adult immigration and holding life stage occurs in the Sacramento River from December through July. The flow and water temperature differences between the CEQA Yuba Accord Alternative and the CEQA Existing Condition, described above, would not be expected to substantially affect the Sacramento River winter-run Chinook salmon adult immigration and holding life stage because:

- By May, the majority of adult winter-run Chinook salmon returning to the Sacramento River to spawn have already migrated upstream of the lower Feather River confluence;
- Only relatively minor and infrequent flow and water temperature changes would be expected to occur throughout this life stage at the lower Feather River confluence or at Freeport (Appendix F4, 3 vs. 1, pgs. 883 through 894 and 1006 through 1017); and
- Overall, for the 568 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in one increase above the 60°F water temperature index value immediately downstream of the Feather River confluence, and no increases above or decreases below the 60°F, 64°F and 68°F index values at Freeport.

The juvenile rearing and outmigration life stage extends from June through April. Only relatively minor and infrequent flow and water temperature changes would be expected to occur throughout this life stage at the lower Feather River confluence or at Freeport, which would not be expected to substantively affect juvenile rearing and outmigration. Overall, for the 781 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in one increase above the 60°F water temperature index value immediately downstream of the Feather River confluence, and no increases above or decreases below the 60°F, 64°F and 68°F juvenile rearing and outmigration water temperature index values at Freeport (Appendix F4, 3 vs. 1, pgs. 883 trough 894, 957 through 968, 1006 through 1017, 1055 through 1066, and Appendix G, 3 vs. 1, pg. G-136).

In conclusion, in consideration of potential effects to all relevant life stages of winter-run Chinook salmon, the CEQA Yuba Accord Alternative would result in a less than significant impact to winter-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.5-19: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

Spring-run Chinook salmon adult immigration and holding extends from February through September. As discussed above, only relatively minor and infrequent flow and water temperature changes would be expected to occur throughout this life stage at the lower Feather River confluence or at Freeport, which would not be expected to substantively affect adult immigration and holding. Overall, immediately downstream of the Feather River confluence, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value, and no increases above or decreases below any water temperature index values at Freeport (Appendix F4, 3 vs. 1, pgs. 883 through 894, 957 through 968, 1006 through 1017, 1055 through 1066, and Appendix G, 3 vs. 1, pg. G-138).

Juvenile rearing occurs year-round in the lower Feather River. Overall, for the 852 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value, immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the juvenile rearing water temperature index values at Freeport. Smolt emigration occurs from October through June in the lower Feather River. Overall, for the 639 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value, immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the index values at Freeport during the smolt emigration life stage. Based on the flow and water temperature modeling results described above, the relatively minor changes that occur in flows and water temperatures would not be expected to substantially affect spring-run Chinook salmon juvenile rearing and smolt emigration (Appendix F4, 3 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of spring-run Chinook salmon, the CEQA Yuba Accord Alternative would result in a less than significant impact to spring-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.5-20: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

Fall-run Chinook salmon adult immigration and holding extends from July through December. Overall, for the 426 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would not result in any increases above or decreases below any of the adult immigration and holding index values, both immediately downstream of the Feather River confluence and at Freeport. Juvenile rearing and outmigration extends from December through June. For the 497 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value, immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the juvenile rearing and outmigration index values at Freeport.

As discussed above, the relatively minor and infrequent changes in flows and water temperatures would not be expected to substantially affect adult immigration and holding, or juvenile rearing and outmigration, under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of fall-run Chinook salmon, the CEQA Yuba Accord Alternative would result in a less than significant impact to fall-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.5-21: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect late fall-run Chinook salmon

Late fall-run Chinook salmon adult immigration and holding extends from October through April. Overall, for the 497 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the adult immigration and holding index values at Freeport. Juvenile rearing and outmigration extends from April through December. For the 639 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the juvenile rearing and outmigration index values at Freeport. Under the CEQA Yuba Accord, the relatively minor and infrequent changes in flows and water temperatures would not be of sufficient magnitude and/or frequency to substantively affect late fall-run Chinook salmon adult immigration and holding, or juvenile rearing and outmigration (Appendix F4, 3 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of late fall-run Chinook salmon, the CEQA Yuba Accord Alternative would result in a less than significant impact to late fall-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.5-22: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect steelhead

In the Sacramento River, the steelhead adult immigration and holding life stage period extends from August through March, the juvenile rearing life stage occurs year-round, and the smolt emigration life stage extends from October through May. Overall, immediately downstream of the Feather River confluence and at Freeport, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would not result in any increases above or decreases below any of the steelhead water temperature index values. Based on the relatively minor and infrequent changes in flow and water temperatures described above, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would not be expected to substantially affect steelhead adult immigration and holding, juvenile rearing, or smolt emigration life stages (Appendix F4, 3 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of steelhead, the CEQA Yuba Accord Alternative would result in a less than significant impact to steelhead, relative to the CEQA Existing Condition.

Impact 10.2.5-23: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect green sturgeon

Green sturgeon adult immigration and holding extends from February through July, adult spawning and embryo incubation extend from March through July, juvenile rearing occurs year-round, and juvenile emigration occurs May through September. Based on the relatively minor and infrequent changes in flow and water temperatures described above, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would not be expected to substantially affect green sturgeon. Additionally, no changes would occur across any water temperature index value for any green sturgeon life stage in the Sacramento River immediately downstream of the Feather River confluence, or at Freeport (Appendix F4, 3 vs. 1, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of green sturgeon, the CEQA Yuba Accord Alternative would result in a less than significant impact to green sturgeon, relative to the CEQA Existing Condition.

Impact 10.2.5-24: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect American shad

American shad adult immigration and spawning extends from April through June. Based on the flow and water temperature modeling results under the CEQA Yuba Accord Alternative relative to the No Project Alternative discussed above, the relatively minor and infrequent changes in flows and water temperatures would not be expected to substantially affect American shad adult immigration and spawning. Additionally, for the 213 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in 1 additional occurrence of water temperatures within the suitable range for American shad adult immigration and spawning immediately downstream of the Feather River confluence (Appendix F4, 3 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the CEQA Yuba Accord Alternative would result in a less than significant impact to American shad, relative to the CEQA Existing Condition.

Impact 10.2.5-25: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect striped bass

Striped bass adult spawning, embryo incubation and initial rearing extend from April through June. Based on the flow and water temperature modeling results under the CEQA Yuba Accord Alternative relative to the No Project Alternative discussed above, the relatively minor and infrequent changes in flows and water temperatures would not be expected to substantially affect striped bass adult spawning, embryo incubation and initial rearing. Additionally, for the 213 months included in the analysis, the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in no increases above or decreases below the 59°F and 68°F index values, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 3 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the CEQA Yuba Accord Alternative would result in a less than significant impact to striped bass, relative to the CEQA Existing Condition.

Impact 10.2.5-26: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail adult spawning, embryo incubation and initial rearing extend from February through May. Over the 72-year simulation period, the frequency with which the Yolo Bypass floodplains would be inundated would be the same under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition. In the Sacramento River immediately downstream of the lower Feather River confluence, for the 288 months included in the analysis, the CEQA Yuba Accord Alternative would not provide any additional months with monthly mean flows greater than 56,000 cfs. These results suggest that the availability of splittail spawning, egg incubation, and initial rearing habitat would be essentially the same under the CEQA Yuba Accord Alternative and the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 883 through 894).

Over the 72-year simulation period, the February through May monthly mean water temperatures on the Sacramento River immediately downstream of the lower Feather River confluence under both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would always be within the suitable range (i.e., 45°F to 75°F) for splittail spawning (Appendix F4, 3 vs. 1, pgs. 957 through 968).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the CEQA Existing Condition, the CEQA Yuba Accord Alternative would be expected to result in a less than significant impact to Sacramento splittail in the Sacramento River.

10.2.5.3 DELTA REGION

The evaluation of biological impacts on delta fisheries resources and their habitats use parameters established by the USFWS, CDFG, NMFS and others, including X2 locations, Delta outflows and E/I ratios, presented below.

X2 LOCATION

Over the entire 72-year period of simulated X2 locations, long-term average X2 locations would not change during any month under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Under the CEQA Yuba Accord Alternative, average X2 location by water year type would range from: 0.1 km higher during February, April, and August to 0.1 km lower during December and September in wet years; 0.2 km higher during September to no change during October through May in above normal years; 0.1 km higher during May, June, August, and September to 0.1 km lower during January and February in below normal years; 0.1 km higher during May, June, and July to 0.1 km lower during December in dry years; and no change during October through May to 0.2 km lower during June and August in critical years (Appendix F4, 3 vs. 1, pg. 1189).

Cumulative distributions of X2 location for the CEQA Yuba Accord Alternative and the CEQA Existing Condition would generally overlap during each month of the year, indicating that the X2 location under each scenario would be downstream of compliance points in the Delta with nearly equal probabilities. Although rare, monthly mean X2 location would occasionally change by 1.0 km or more, including the following occasions: (1) one downstream movement (1.2 km) during December; (2) one downstream movement (1.4 km) during January; and (3) one upstream movement (1.0 km) during January. During these months, there would be no instances when a 1.0 km or more change in X2 location would result in the movement of X2 past designated compliance points at Roe Island, Chipps Island, or the Confluence (Appendix F4, 3 vs. 1, pgs. 1214 through 1225).

Over the entire 72-year simulation period during the delta smelt spawning season (February through June), the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition would result in a 0.5 km or greater upstream shift while X2 is located between Chipps Island and the Confluence compliance points during 2 out of 360 months included in the analysis, and downstream shifts during 5 out of 360 months. These upstream/downstream shifts would occur 3 times during February and 4 times during June (Appendix F4, 3 vs. 1, pgs. 1190 through 1201).

DELTA OUTFLOW

Over the entire 72-year period of simulated Delta outflow, long-term average Delta outflow would not change during any month under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Under the CEQA Yuba Accord Alternative, average Delta outflow by water year type would range from: 1 percent higher during October and August to 1 percent lower during July in wet years; 1 percent higher during November to 2 percent lower during August in above normal years; 1 percent higher during December and January to 1 percent lower during April, May, July, August, and September in below normal years; 1 percent higher during November and July to 2 percent lower during May in dry years; and 3 percent higher during May to no change during October through March, June, and August in critical years (Appendix F4, 3 vs. 1, pg. 1140).

Over the 72-year period of simulation the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in increases in the percentage of Delta outflows of 5 percent or more in 16 out of 864 months included in the analysis, and decreases of 5 percent or more in 12 out of 864 months (Appendix F4, 3 vs. 1, pgs. 1141 through 1152).

EXPORT-TO-INFLOW RATIO

Delta E/I ratio limits are built into the CALSIM modeling assumptions and, therefore, are consistently met under both the Proposed Action and Environmental Baseline during all months of the year. Nevertheless, over the entire 72-year period of simulated E/I ratios, long-term average E/I ratio would not change during any month except July, which would result in a 1 percent decrease under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 1238). Under the CEQA Yuba Accord Alternative, average E/I ratio by water year type would result in no change during any month except July, which would result in a 1 percent decrease in wet years; no change during any month except August which would result in a 1 percent decrease in above normal years; no change during any month except July which would result in a 1 percent decrease in below normal years; no change during any month in dry years; and 1 percent lower during July to 1 percent higher during September in critical years (Appendix F4, 3 vs. 1, pgs. 1239 through 1250).

Over the 72-year period of simulation the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would result in a maximum change of 5 percent in the E/I ratios during all months included in the analysis. Moreover, increases in the percentage of E/I ratios would not exceed 5 percent in any of the 864 months included in the analysis (Appendix F4, 3 vs. 1, pgs. 1239 through 1250).

SALVAGE ESTIMATION

Delta Smelt

The combined overall estimated salvage for delta smelt at the CVP and SWP salvage facilities would decrease by 0.5 percent under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type would change by: (1) 0.2 percent decrease during wet years; (2) 0.9 percent decrease in above normal years; (3) 0.3 percent decrease during below normal years; (4) 0.6 percent decrease during dry years; and (5) 0.6 percent decrease during critical years, under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 1336).

Winter-run Chinook Salmon

The combined overall estimated salvage for winter-run Chinook salmon at the CVP and SWP salvage facilities would decrease by 0.1 percent under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type would change by: (1) no change during wet, above normal, and below normal years; (2) 0.7 percent decrease in dry years; and (3) 0.2 percent increase during critical years, under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 1324).

Spring-run Chinook Salmon

The combined overall estimated salvage for spring-run Chinook salmon at the CVP and SWP salvage facilities would decrease by 0.2 percent under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type would change by: (1) 0.1 percent decrease during wet and above normal years; (2) no change in below normal years; (3) 1.3 percent decrease during dry years; and (4) no change during critical years, under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 1324).

Steelhead

The combined overall estimated salvage for steelhead at the CVP and SWP salvage facilities would decrease by 0.1 percent under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type would change by: (1) 0.2 percent decrease during wet years; (2) no change in above normal years; (3) 0.1 percent decrease during below normal years; (4) 0.6 percent decrease during dry years; and (5) 0.2 percent increase during critical years, under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pg. 1333).

Striped Bass

The combined overall estimated salvage for striped bass at the CVP and SWP salvage facilities would decrease by 1.1 percent under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type would change by: (1) 1.5 percent decrease during wet years; (2) 1.6 percent decrease in above normal years; (3) 0.9 percent decrease during below normal years; (4) 0.2 percent decrease during dry years; and (5) 0.3 percent decrease during critical years, under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 1334 and 1335).

Impact 10.2.5-27: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect delta smelt

Model results indicate 3 additional 0.5 km downstream movements in the location of X2 while X2 is located between Chipps Island and the Confluence compliance points in response to implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, as described above. The frequency and magnitude of these changes would not be expected to substantially affect delta smelt habitat.

Changes in monthly mean outflow in the Delta, as well as the E/I ratio, would be relatively infrequent and of minor magnitude under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. In addition, overall delta smelt estimated salvage at the CVP and SWP facilities would decrease by 0.5 percent, and would decrease during every water year type from 0.2 to 0.9 percent, under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated delta smelt salvage, the CEQA Yuba Accord Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to delta smelt (Appendix F4, 3 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.5-28: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect winter-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect winter-run Chinook salmon habitat. In addition, overall estimated winter-run Chinook salmon salvage at the CVP and SWP facilities would decrease by 0.1 percent under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated winter-run Chinook salmon salvage, the CEQA Yuba Accord Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to winter-run Chinook salmon (Appendix F4, 3 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.5-29: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect spring-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect spring-run Chinook salmon habitat. In addition, overall estimated spring-run Chinook salmon salvage at the CVP and SWP facilities would decrease by 0.2 percent under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated spring-run Chinook salmon salvage, the CEQA Yuba Accord Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to spring-run Chinook salmon (Appendix F4, 3 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.5-30: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect steelhead

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect steelhead habitat. In addition, overall estimated steelhead salvage at the CVP and SWP facilities would decrease by 0.1 percent under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated steelhead salvage, the CEQA Yuba Accord Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to steelhead Appendix F4, 3 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.5-31: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect striped bass

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect striped bass habitat. In addition, overall estimated striped bass salvage at the CVP and SWP facilities would decrease by 1.1 percent under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated striped bass salvage, the CEQA Yuba Accord Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to striped bass (Appendix F4, 3 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.5-32: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) could affect other Delta fisheries resources

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, as described above under the CEQA Yuba Accord Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect other Delta fisheries resources habitats. In conclusion, the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to other Delta fisheries resources (Appendix F4, 3 vs. 1, pgs. 1140, 1189, and 1238).

10.2.5.4 EXPORT SERVICE AREA

SAN LUIS RESERVOIR

Impact 10.2.5-33: Decreases in San Luis Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Simulated decreases in the water surface elevation of San Luis Reservoir by more than 6 feet per month would occur one more time in March under the Yuba Accord Alternative relative to CEQA Existing Condition. Simulated decreases in water surface elevation by more than 6 feet per month would occur the same number of times during April through June under the Yuba Accord Alternative relative to the CEQA Existing Condition. The reduction in water surface elevation during March would not be anticipated to result in substantial reductions in warmwater fish spawning success or the self-sustainability of warmwater fish populations, because a decrease in water surface elevation would not be expected to occur during more than one month of any spawning season. In addition, a 60 percent nest success rate or greater would be achieved during some months of any annual spawning season, which would be expected to provide sufficient recruitment of individuals into the population over the 72-year simulation period. Therefore, changes in water surface elevations that could occur under the CEQA Yuba Accord Alternative would result in a less than significant impact to San Luis Reservoir warmwater fisheries, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 1438 through 1449).

Impact 10.2.5-34: Decreases in San Luis Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Long-term average end of month storage volumes under the CEQA Yuba Accord Alternative would not change from April through November relative to the CEQA Existing Condition. Average end of month storage volumes also would not change from April through November during most water year types, with the exception of dry water year types. During dry water year types, end of month storage volumes would be up to 1 percent lower during May, June, October and November, up to 2 percent lower during July, August, and September. These relatively minor and infrequent changes in end-of-month reservoir storage under the CEQA Yuba Accord Alternative would not unreasonably affect San Luis Reservoir coldwater fisheries resources, and would provide an equivalent level of protection, relative to the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 1339 and 1376).

10.2.6 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE CEQA MODIFIED FLOW ALTERNATIVE COMPARED TO THE CEQA EXISTING CONDITION

10.2.6.1 YUBA REGION

NEW BULLARDS BAR RESERVOIR

Impact 10.2.6-1: Decreases in New Bullards Bar Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June, with the majority of warmwater fish spawning occurring during the months of April and May. Decreases in the water surface elevation of New Bullards Bar Reservoir by more than 6 feet per month would occur the same number of times from March through May, and three (out of 72) times more often during June under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 75 through 86). These reductions in water surface elevations would not be anticipated to result in substantial reductions in warmwater fish spawning success because these potential decreases in water surface elevation would not be expected to occur during more than one month of any spawning season. In addition, a 60 percent nest success rate or greater would be achieved during some months of any annual spawning season, which would be expected to provide sufficient recruitment of individuals into the population over the 72-year simulation period. Therefore, changes in water surface elevations that could occur under the CEQA Modified Flow Alternative would result in a less than significant impact on New Bullards Bar Reservoir warmwater fisheries, relative to the CEQA Existing Condition.

Impact 10.2.6-2: Decreases in New Bullards Bar Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

The CEQA Modified Flow Alternative would result in long-term average New Bullards Bar Reservoir storage of approximately 822 TAF in April to 579 TAF in November (Appendix F4, 4 vs. 1, pg. 1). This reduction would correspond to a change in water surface elevation from approximately 1,924 feet msl to 1,860 feet msl. Under the CEQA Existing Condition, the November long-term average storage in New Bullards Bar Reservoir would be approximately 567 TAF with a corresponding elevation of 1,857 feet msl. End of month storage volumes would range from the same, to four percent higher, under the CEQA Modified Flow Alternative relative to CEQA Existing Condition depending on water year type (Appendix F4, 4 vs. 1, pg. 50).

Anticipated changes in reservoir storage associated with the CEQA Modified Flow Alternative would not be expected to substantively affect the New Bullards Bar Reservoir's coldwater fisheries because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample coldwater pool reserves. Therefore, changes in end-of-month storage that could occur under the CEQA Modified Flow Alternative would result in a less than significant impact on New Bullards Bar Reservoir coldwater fisheries, relative to the CEQA Existing Condition.

Lower Yuba River

The following sections describe and discuss flow and water temperature differences between the CEQA Modified Flow Alternative and the CEQA Existing Condition, and potential effects on fisheries and aquatic resources in the lower Yuba River.

Impact 10.2.6-3: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The adult immigration and holding life stage primarily extends from March through October. Evaluation of flows at Marysville occurring under the CEQA Modified Flow Alternative and the CEQA Existing Condition indicate that both alternatives would provide adequate flows for adult spring-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam (Appendix F4, 4 vs. 1, pg. 272). Also, under the CEQA Modified Flow Alternative and the CEQA Existing Condition, flows in the lower Yuba River throughout the upstream migration period generally would remain within the range sufficient to allow adequate passage of adult spring-run Chinook salmon through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville would result in the same number of occurrences (4 out of 576 months included in the analysis) during which flows at the Daguerre Point Dam fish ladders exceed 10,000 cfs under both the CEQA Modified Flow Alternative and the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 273 through 284). Finally, under the CEQA Modified Flow Alternative and the CEQA Existing Condition, stages at Smartville throughout the adult holding period remain similar. Overall, examination of monthly mean stage simulated at Smartville would result in 1 decrease of one foot or more (for the 576 months included in the analysis) under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 162 through 173). These relatively infrequent and minor changes in stage would not affect adult spring-run Chinook salmon holding habitat conditions, particularly due to the deep nature of the pools in the Narrows Reach below Englebright Dam.

During the March through October adult immigration and holding life stage, water temperatures at Smartville, under both the CEQA Modified Flow Alternative and the CEQA Existing Condition, generally would remain at or below 57°F, which is below the lowest water temperature index value (60°F), and therefore would remain suitable, for this life stage (Appendix F4, 4 vs. 1, pg. 174).

Simulated water temperatures at Daguerre Point Dam under both the CEQA Modified Flow Alternative and the CEQA Existing Condition generally would not exceed 60°F over the entire cumulative water temperature distributions from March through May, and during July, August and October. However, during June at Daguerre Point Dam under the CEQA Modified Flow Alternative, water temperatures would remain below 60°F with about a 90 percent probability, by contrast to about an 80 percent probability under the CEQA Existing Condition. During September under the CEQA Modified Flow Alternative, water temperatures would remain below 60°F with about a 60 percent probability, and about a 70 percent probability under the CEQA Existing Condition. Measurable water temperature reductions, and therefore more suitable conditions, generally would occur during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures equal or exceed 60°F under the CEQA Existing Condition. Overall, during the entire March through October adult immigration and holding period at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 5 decreases below the 60°F index value, 1 increase above the 64°F index value, and no changes at the 68°F index value (Appendix G, 4 vs. 1, pgs. G-152 through G-154).

In addition, while the presence of spring-run Chinook salmon below Daguerre Point Dam during the immigration and holding life stage is believed to be transitory, the cumulative water temperature distribution under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, indicates that generally cool (< 60°F), and therefore more suitable water temperatures at Marysville during March and April. During May and June, water temperatures would be generally equivalent over the entire cumulative water temperature distributions. From July through September at Marysville, measurably lower, and therefore more suitable, water temperatures typically would occur under some of the warmest water temperature conditions, although measurable water temperature increases consistently would occur from intermediate to cool water temperature conditions. During October, measurable water temperature increases would occur when water temperatures are below 60°F, and therefore would remain suitable for this life stage. Overall, during the March through October adult immigration and holding life stage at Marysville, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in 22 increases above the 60°F index value, 6 increases above the 64°F index value, and 6 decreases below the 68°F index value (Appendix F4, 4 vs. 1, pgs. 371 through 382).

Spring-run Chinook salmon spawning reportedly occurs above Daguerre Point Dam from September through November. During these months, the annual spawning habitat availability under the CEQA Modified Flow Alternative would be slightly higher than under the CEQA Existing Condition (long-term average of 90.1 percent versus 89.1 percent of the maximum WUA) (Appendix F4, 4 vs. 1, pg. 395). The CEQA Modified Flow Alternative would achieve over 90 percent of maximum WUA with a 71 percent probability, while the CEQA Existing Condition would achieve over 90 percent of maximum WUA with a 65 percent probability.

Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 4 vs. 1, pg. 399).

The spring-run Chinook salmon spawning habitat analysis also emphasized the month of September, because this is the only month during the spring-run Chinook salmon spawning period that is assumed to not temporally overlap with fall-run Chinook salmon spawning (CDFG 2000). For September, spawning habitat availability, expressed as percent maximum WUA, under the CEQA Modified Flow Alternative would be slightly higher than under the CEQA Existing Condition (long-term average of 88.5 percent versus 87.2 percent of maximum WUA) (Appendix F4, 4 vs. 1, pg. 395). Overall, for the month of September, the CEQA Modified Flow Alternative would achieve over 90 percent of maximum WUA with about a 58 percent probability, whereas the CEQA Existing Condition would achieve over 90 percent of maximum WUA with about a 55 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative September WUA distributions (Appendix F4, 4 vs. 1, pg. 397).

Water temperatures at Smartville during the September through November spawning period generally would not exceed 56°F, and therefore would remain suitable for this life stage (Appendix F4, 4 vs. 1, pgs. 175 through 186). Simulated water temperatures at Daguerre Point Dam during November would not exceed 56°F, and therefore would remain suitable for adult spawning (Appendix F4, 4 vs. 1, pgs. 224 through 235). During September, simulated water temperatures at Daguerre Point Dam under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would exceed 56°F over the entire cumulative water temperature distributions. Under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, water temperatures would be essentially equivalent over approximately 70 percent, measurably higher over approximately 15 percent, and measurably lower over approximately 15 percent of the cumulative water temperature distributions during September. During relatively warm water temperature conditions, water temperatures under the CEQA Modified Flow Alternative would be generally lower, and therefore more suitable, than under the CEQA Existing Condition during September. During October, simulated water temperatures at Daguerre Point Dam under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would exceed 56°F with slightly more than a 90 percent probability, and would be essentially equivalent over nearly the entire cumulative water distribution (Appendix F4, 4 vs. 1, pgs. 248 through 259). Overall, during the entire September through November spawning period, at Daguerre Point Dam the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 1 increase above the 56°F index value, 3 increases above the 58°F index value, 5 increases above the 60°F index value, and 7 decreases below the 62°F index value (Appendix G, 4 vs. 1, pgs. G-152 through G-154).

The embryo incubation life stage for spring-run Chinook salmon in the lower Yuba River generally occurs between September and March. As indicated above for the spawning life stage, water temperatures at Daguerre Point Dam under the CEQA Modified Flow Alternative would be essentially equivalent over approximately 70 percent, would be measurably higher over approximately 15 percent, and would be measurably lower over approximately 15 percent of the cumulative water temperature distributions during September. During relatively warm water temperature conditions, water temperatures under the CEQA Modified Flow Alternative would be generally lower, and therefore more suitable, than under the CEQA Existing Condition during September. During October, water temperatures would be essentially equivalent, and from November through March generally would not exceed 53°F, would not approach the lowest water temperature index value (56°F), and therefore would remain suitable, at Daguerre Point Dam under both the CEQA Modified Flow Alternative and the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 248 through 259).

Spring-run Chinook salmon juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to spring-run Chinook salmon juveniles.

Simulated water temperatures at Smartville generally would remain below the lowest water temperature index value (60°F), and therefore would remain suitable for this life stage year-round, under both the CEQA Modified Flow Alternative and the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 175 through 186). At Daguerre Point Dam, water temperatures generally would remain below 60°F, and therefore suitable, during most months, with the exceptions of June and September (Appendix F4, 4 vs. 1, pgs. 224 through 235). During June at Daguerre Point Dam under the CEQA Modified Flow Alternative, water temperatures would remain below 60°F with about a 90 percent probability, by contrast to about an 80 percent probability under the CEQA Existing Condition. During September under the CEQA Modified Flow Alternative, water temperatures would remain below 60°F with about a 60 percent probability, and about a 70 percent probability under the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 248 through 259). Measurable water temperature reductions, and therefore more suitable conditions, generally would occur during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures would equal or exceed 60°F under the CEQA Existing Condition. At Marysville, water temperatures generally would remain below the lowest water temperature index value (60°F), and therefore would remain suitable for this life stage from November through April, under both the CEQA Modified Flow Alternative and the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 347 through 358). During May and June, water temperatures would be generally equivalent over the entire cumulative water temperature distributions. From July through September at Marysville, measurably lower, and therefore more suitable, water temperatures typically would occur under some of the warmest water temperature conditions, although measurable water temperature increases consistently would occur from intermediate to cool water temperature conditions. During October, measurable water temperature increases would occur when water temperatures are below 60°F, and therefore would remain suitable for this life stage (Appendix F4, 4 vs. 1, pgs. 371 through 394).

Overall, during the year-round juvenile rearing life stage at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 5 decreases below the 60°F index value, no change at the 63°F index value, 3 increases above the 65°F index value, no change at the 68°F, 70°F or 75°F index values. Overall, at Marysville, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 22 increases above the 60°F index value, 11 increases above the 63°F index value, 3 increases above the 65°F index value, 6 decreases below the 68°F index value, 2 decreases below the 70°F index value, and 1 increase above the 75°F index value (Appendix G, 4 vs. 1, pgs. G-152 through G-154).

The spring-run Chinook salmon smolt emigration period is believed to extend from November through June, although based on CDFG's run-specific determinations, the vast majority (about 94 percent) of spring-run Chinook salmon were captured as post-emergent fry during November and December, with a relatively small percentage (nearly 6 percent) of individuals remaining in the lower Yuba River and captured as YOY from January through March. Only

0.6 percent of the juvenile Chinook salmon identified as spring-run was captured during April, 0.1 percent during May, and none were captured during June. Differences in flows under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition exhibit similar trends at Smartville and at Marysville, from November through February. During November, measurable flow decreases generally would occur at intermediate to high flow levels, which would not be expected to substantively affect smolt emigration, by contrast to measurable flow increases at low to intermediate flow levels, which may facilitate smolt emigration. During December, frequent measurable flow increases would occur at low to intermediate flow levels. Slight but measurable flow increases would occur at the lowest flow levels, and flow increases of greater than 10 percent would occur at intermediate flow levels during January. During February, flows would be generally similar under both alternatives (Appendix F4, 4 vs. 1, pgs. 125 through 136 and 297 through 308).

At Smartville, measurable flow decreases would occur at intermediate flow levels during March. Measurable flow increases would occur at low to intermediate flow levels during April, May and June. At Marysville, consistent and measurable flow decreases would occur at low to intermediate flow levels during March, yet remain above 750 cfs with about a 95 percent probability; at all but the lowest flow levels during April, yet remain above about 500 cfs with an 80 percent probability; and at intermediate to high flow levels (about ≥ 1,550 cfs) during May and June (Appendix F4, 4 vs. 1, pgs. 125 through 148).

During the November through June smolt emigration life stage, water temperatures at Smartville under both the CEQA Modified Flow Alternative and the CEQA Existing Condition generally would remain below 60°F, and therefore would remain suitable for this life stage (Appendix F4, 4 vs. 1, pgs. 175 through 186 and 199 through 210). At Daguerre Point Dam, water temperatures generally would remain below 60°F from November through May. During June under the CEQA Modified Flow Alternative, water temperatures would remain below 60°F with about a 90 percent probability, by contrast to about an 80 percent probability under the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 248 through 259). At Marysville, water temperatures generally would remain below the lowest water temperature index value (60°F), and therefore would remain suitable for this life stage from November through April, under both the CEQA Modified Flow Alternative and the CEQA Existing Condition. During May and June, water temperatures would be generally equivalent over the entire cumulative water temperature distributions, and would exceed 60°F with about a 25 percent probability during May and about a 55 percent probability during June (Appendix F4, 4 vs. 1, pgs. 371 through 382).

Overall, during the entire November through June smolt emigration period at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 4 decreases below the 60°F index value, and no changes at other index values (Appendix G, 4 vs. 1, pgs. G-152 through G-154). Overall at Marysville, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, would result in 2 increases above the 60°F index value, and no changes at other index values (Appendix G, 4 vs. 1, pgs. G-152 through G-154).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) similar holding habitat conditions above Daguerre Point Dam; and (4) generally equivalent water temperatures at Daguerre Point Dam
- Improved spawning conditions due to: (1) slightly higher spawning habitat availability during the entire September through November adult spawning period; (2) higher spawning habitat availability during September separately as a temporally distinct month; and (3) generally lower, and therefore more suitable water temperatures during September during about 20 percent of the warmest water temperature conditions, which represent otherwise stressful conditions for this life stage
- Improved embryo incubation conditions due to generally lower, and therefore more suitable water temperatures during September during about 20 percent of the warmest water temperature conditions, which represent otherwise stressful conditions for this life stage, and generally equivalent water temperatures during October
- Generally equivalent or less suitable over-summer juvenile rearing conditions due to: (1) generally equivalent water temperatures during May and June at Marysville; (2) measurably lower, and therefore more suitable, water temperatures during July through September under the relatively infrequently occurring warmest (≥ 66°F) water temperature conditions at Marysville; and (3) consistent and measurably higher, and therefore less suitable, water temperatures under the relatively frequently occurring range from about 60 - 66°F during July through September at Marysville
- Generally equivalent smolt emigration conditions due to: (1) measurable flow decreases at intermediate to high flow levels, with measurable flow increases at low to intermediate flow levels from November through January; (2) measurable flow decreases at intermediate flow levels during March, and measurable flow increases at low to intermediate flow levels during April, May and June at Smartville; (3) at Marysville, consistent and measurable flow decreases at low to intermediate flow levels during March, yet remain above 750 cfs with about a 95 percent probability; at nearly all but the lowest flow levels during April, yet remain above about 500 cfs with an 80 percent probability; and at intermediate to high flow levels (about ≥ 1,550 cfs) during May and June; and (4) generally equivalent water temperatures during this life stage

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Yuba River spring-run Chinook salmon.

Impact 10.2.6-4: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The adult immigration and holding life stage for fall-run Chinook salmon in the lower Yuba River primarily extends from August through November. Evaluation of flows at Marysville occurring under the CEQA Modified Flow Alternative and the CEQA Existing Condition indicate that both alternatives would provide adequate flows for adult fall-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam. Also, under the CEQA Modified Flow Alternative and the CEQA Existing Condition, flows in the lower Yuba River throughout the upstream migration period would remain within the range sufficient to allow adequate passage of adult fall-run Chinook salmon through the Daguerre Point Dam fish ladders.

During August and September at Smartville, flows exhibit the trend of measurable flow increases under relatively low flow conditions, but consistent and substantial decreases at intermediate to high flow levels. During October at Smartville, measurable flow decreases would consistently occur from intermediate to high flow levels, and measurable flow increases would consistently occur from low to intermediate flow levels (Appendix F4, 4 vs. 1, pgs. 125 through 136). At Marysville during August and September, substantial flow reductions would occur at all but the lowest flow levels. During October at Marysville, measurable flow decreases would consistently occur at all but the lowest flow levels, at which they would remain generally equivalent. During November at both locations, measurable flow decreases would generally occur at intermediate to high flow levels, which would not be expected to substantively affect adult immigration and holding, by contrast to measurable flow increases at low to intermediate flow levels (Appendix F4, 4 vs. 1, pgs. 297 through 308).

During the August through November adult immigration and holding life stage, water temperatures at Smartville, under both the CEQA Modified Flow Alternative and the CEQA Existing Condition, generally would remain at or below 56°F, which is below the lowest water temperature index value (60°F), and therefore would remain suitable, for this life stage (Appendix F4, 4 vs. 1, pgs. 175 through 186).

At Daguerre Point Dam, water temperatures generally would remain below 60°F, and therefore suitable, during this life stage, with the exception of September. During September under the CEQA Modified Flow Alternative, water temperatures would remain below 60°F with about a 60 percent probability, and about a 70 percent probability under the CEQA Existing Condition. Measurable water temperature reductions, and therefore more suitable conditions, generally would occur during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures would equal or exceed 60°F under the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 236 through 247). At Marysville, water temperatures generally would remain below the lowest water temperature index value (60°F), and therefore would remain suitable for this life stage during November under both the CEQA Modified Flow Alternative and the CEQA Existing Condition. During September at Marysville, measurably lower, and therefore more suitable, water temperatures typically would occur under some of the warmest water temperature conditions, although measurable water temperature increases would consistently occur from intermediate to cool water temperature conditions. During October, measurable water temperature increases would occur when water temperatures are below 60°F, and therefore would remain suitable for this life stage (Appendix F4, 4 vs. 1, pgs. 371 through 382).

Overall, during the entire August through November adult immigration and holding period at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 2 increases above the 60°F index value, 1 increase above the 64°F index value, and no change at the 68°F index value (Appendix F4, 4 vs. 1, pgs. 224 through 235). Overall at Marysville, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, would result in 11 increases above the 60°F index value, 6 increases above the 64°F index value, and 3 decreases below the 68°F index value (Appendix F3, 4 vs. 1, pgs. 347 through 358).

Fall-run Chinook salmon spawning occurs in the lower Yuba River from October through December, and may extend into January. During these months, the annual spawning habitat availability under the CEQA Modified Flow Alternative would be slightly higher than under the CEQA Existing Condition (long-term average of 89.4 percent versus 88.6 percent of the maximum WUA) (Appendix F4, 4 vs. 1, pg. 400). The CEQA Modified Flow Alternative would achieve over 90 percent of maximum WUA with a 72 percent probability, while the CEQA Existing Condition would achieve over 90 percent of maximum WUA with a 70 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 4 vs. 1, pg. 402).

During the October through December adult spawning life stage, water temperatures at Smartville, under both the CEQA Modified Flow Alternative and the CEQA Existing Condition, generally would remain at or below 56°F, and therefore remain suitable for this life stage (Appendix F4, 4 vs. 1, pgs. 199 through 210). Simulated water temperatures at Daguerre Point Dam during November and December also would not exceed 56°F. During October at Daguerre Point Dam, water temperatures would be essentially equivalent over nearly the entire cumulative water temperature distribution. Water temperatures under both alternatives would exceed 56°F nearly 90 percent of the time, yet generally would remain below 58°F (Appendix F4, 4 vs. 1, pgs. 248 through 259). During October at Marysville, water temperatures would be essentially equivalent about 80 percent of the time, with measurable water temperature increases occurring about 20 percent of the time. The measurable water temperature increases would occur at low to intermediate water temperature conditions, when water temperatures would range from about 57 - 59°F. At Marysville, water temperatures would generally remain below the lowest water temperature index value (56°F), and therefore would remain suitable for this life stage during November and December under both the CEQA Modified Flow Alternative and the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 371 through 382).

Overall, the CEQA Modified Flow Alternative would result in 1 increase above the 56°F index value, and no changes at other index values at Daguerre Point Dam; and no changes at the 56°F index value, 4 increases above the 58°F index value, and no changes at the 60°F or 62°F index values at Marysville (Appendix F4, 4 vs. 1, pgs. 224 through 235 and 347 through 358).

The embryo incubation period for fall-run Chinook salmon extends from October through March. In addition to the trends described above, between January and March, water temperatures would not exceed 54°F, would not approach the lowest water temperature index value (56°F), and therefore would remain suitable, at Daguerre Point Dam and Marysville under the CEQA Modified Flow Alternative and the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 248 through 259 and 371 through 382). Overall, during the embryo incubation life stage, the CEQA Modified Flow Alternative would result in 1 increase above the 56°F index value, and no changes at other index values at Daguerre Point Dam, relative to CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 224 through 235).

Juvenile fall-run Chinook salmon rear in and emigrate from the lower Yuba River between December and June, although based on CDFG's run-specific determinations, the majority (about 81 percent) of fall-run Chinook salmon are captured moving downstream from December through March, with decreasing numbers captured during April (about 9 percent), May (about 7 percent), and June (about 3 percent). The discussion of flow and water temperature changes provided for spring-run Chinook salmon smolt emigration (see above) encompasses the entire fall-run Chinook salmon juvenile rearing and outmigration time period. The only differences are that the juvenile fall-run Chinook salmon rearing and outmigration period encompasses one less month (November), and includes slightly different water temperature index values. Overall, during the entire December through June juvenile rearing and outmigration period at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 4 decreases below the 60°F index value, and no changes at other values. Overall at Marysville, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, would result in 2 increases above the 60°F index value, no change at the 63°F index value, 1 increase above the 65°F index value, and no changes at the 68°F or 70°F index values (Appendix G, 4 vs. 1, pgs. G-156 through G-157).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) generally equivalent and/or suitable water temperatures at Daguerre Point Dam and Marysville, with the exception of September; (4) measurable water temperature reductions, and therefore more suitable conditions, during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures equal or exceed 60°F; and (5) measurably lower, and therefore more suitable, water temperatures under some of the warmest water temperature conditions (approximately the warmest 20 percent of simulated water temperature conditions), with consistent measurable water temperature increases from intermediate to cool water temperature conditions during September at Marysville
- Generally equivalent spawning conditions due to: (1) slightly higher spawning habitat availability during the adult spawning period; (2) generally equivalent water temperatures at Smartville and at Daguerre Point Dam throughout this life stage; and (3) measurable water temperature increases at low to intermediate water temperature conditions at Marysville during October, when water temperatures range from about 57 - 59°F
- Generally equivalent or less suitable embryo incubation conditions due to similar water temperatures at Smartville and at Daguerre Point Dam throughout this life stage, and measurable water temperature increases at low to intermediate water temperature conditions (57 - 59°F) at Marysville during October
- Generally equivalent juvenile rearing and outmigration conditions due to: (1) measurable flow decreases at intermediate to high flow levels, with measurable flow increases at low to intermediate flow levels during December and January; (2) measurable flow decreases at intermediate flow levels during March, and measurable flow increases at low to intermediate flow levels during April, May and June at Smartville; (3) at Marysville, consistent and measurable flow decreases at low to intermediate flow levels during March, yet remain above 750 cfs with about a 95 percent probability; at nearly all but the lowest flow levels during April, yet remain above about 500 cfs with an 80 percent probability; and at intermediate to high flow levels (about ≥ 1,550 cfs) during May and June; and (4) generally equivalent water temperatures during this life stage

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Yuba River fall-run Chinook salmon.

Impact 10.2.6-5: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the lower Yuba River extends from August through March. Evaluation of flows at Marysville occurring under the CEQA Modified Flow Alternative and the CEQA Existing Condition indicate that both alternatives would provide adequate flows for adult steelhead upstream critical riffle passage below Daguerre Point Dam. Also, under the CEQA Modified Flow Alternative and the CEQA Existing Condition, flows in the lower Yuba River throughout the upstream migration period generally would remain within the range sufficient to allow adequate passage of adult steelhead through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville would result in 1 additional occurrence during which flows at the Daguerre Point Dam fish ladders would exceed 10,000 cfs under the CEQA Modified Flow Alternative (15 out of 576 months included in the analysis), relative to the CEQA Existing Condition (14 out of 576 months) (Appendix F4, 4 vs. 1, pgs. 273 through 284).

During August and September of the adult immigration and holding life stage at Smartville, flows exhibit the trend of measurable flow increases under relatively low flow conditions, but consistent and substantial decreases at intermediate to high flow levels. During October at Smartville, measurable flow decreases consistently would occur from intermediate to high flow levels, and measurable flow increases consistently would occur from low to intermediate flow levels (Appendix F4, 4 vs. 1, pgs. 125 through 136). At Marysville during August and September, substantial flow reductions would occur at all but the lowest flow levels. During October at Marysville, measurable flow decreases consistently would occur at all but the lowest flow levels, at which they would remain generally equivalent (Appendix F4, 4 vs. 1, pgs. 297 through 308). Differences in flows under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition exhibit similar trends at Smartville and at Marysville, from November through February. During November, measurable flow decreases would generally occur at intermediate to high flow levels, which would not be expected to substantively affect adult immigration and holding, by contrast to measurable flow increases at low to intermediate flow levels. During December, frequent measurable flow increases would occur at low to intermediate flow levels. Slight but measurable flow increases would occur at the lowest flow levels, and flow increases of greater than 10 percent would occur at intermediate flow levels during January. During February, flows would be generally similar under both alternatives. At Smartville, measurable flow decreases would occur at intermediate flow levels during March. At Marysville, consistent and measurable flow decreases would occur at low to intermediate flow levels during March, yet would remain above 750 cfs with about a 95 percent probability.

During the adult immigration and holding life stage, water temperatures at Smartville during August, September, and October would always exceed 52°F, yet generally would remain below 56°F under both the CEQA Modified Flow Alternative and the CEQA Existing Condition. From November through March, water temperatures consistently would remain below 52°F under both alternatives at Smartville (Appendix F4, 4 vs. 1, pgs. 199 through 210).

At Daguerre Point Dam during August and September, under the CEQA Modified Flow Alternative water temperature increases would occur at intermediate to low water temperature conditions, by contrast to water temperature decreases at warm water temperature conditions - water temperatures typically would exceed 56°F under both alternatives. Water temperatures would be equivalent over nearly the entire cumulative water temperature distribution in October, and would generally remain below 52°F, and therefore would remain suitable, from November through March under both alternatives (Appendix F4, 4 vs. 1, pgs. 248 through 259).

At Marysville, water temperatures generally would exceed the water temperature index values of 52°F and 56°F from August through October under both the CEQA Modified Flow Alternative and the CEQA Existing Condition. Measurable water temperature increases consistently would occur at nearly all but the warmest water temperature conditions during August, at low to intermediate water temperature conditions during September, and under relatively low conditions during October under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. During November, water temperatures would be essentially equivalent and would remain below the 52°F index value, and therefore would remain suitable for this life stage approximately 40 percent of the time, and would range from approximately 52 – 54°F approximately 60 percent of the time. From December through February, water temperatures generally would remain below the lowest water temperature index value (52°F), and therefore would remain suitable for this life stage, under both the CEQA Modified Flow Alternative and the CEQA Existing Condition. During March, water temperatures would be essentially equivalent and remain below 52°F more than 50 percent of the time, and always remain below 54°F (Appendix F4, 4 vs. 1, pgs. 371 through 382).

Overall, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in no changes at the 52°F index value, 4 increases above the 56°F index value, and no changes at the 70°F index value at Daguerre Point Dam (Appendix F4, 4 vs. 1, pgs. 224 through 235). Overall, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 1 decrease below the 52°F index value, and 1 increase above the 56°F index value, and no change at the 70°F index value at Marysville (Appendix F4, 4 vs. 1, pgs. 347 through 358).

The steelhead spawning season generally extends from January through April, primarily occurring in reaches upstream of Daguerre Point Dam. During these months, the annual spawning habitat availability under the CEQA Modified Flow Alternative would be similar to that under the CEQA Existing Condition (long-term average of 38.0 percent versus 38.5 percent of the maximum WUA) (Appendix F4, 4 vs. 1, pg. 403). Both the CEQA Modified Flow Alternative and the CEQA Existing Condition would achieve over 50 percent of maximum WUA with about a 35 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 4 vs. 1, pg. 405).

From January through April at Smartville and from January through March at Daguerre Point Dam, water temperatures would generally remain below 52°F, which is the lowest water temperature index value for this life stage, and therefore would remain suitable for adult spawning. During April at Daguerre Point Dam, water temperatures would be essentially equivalent over the entire cumulative water temperature distributions under both alternatives - and would remain below 52°F with about a 30 percent probability, and would always remain below 56°F (Appendix F4, 4 vs. 1, pgs. 199 through 210 and 248 through 259). Overall, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 1 decrease below the 54°F index value, and no changes at other index values at Daguerre Point Dam (Appendix F4, 4 vs. 1, pgs. 224 through 235).

The embryo incubation period for steelhead in the lower Yuba River general overlaps with the spawning period, but extends into May. During May, water temperatures at Smartville and Daguerre Point Dam would be essentially equivalent over nearly the entire cumulative water temperature distributions. Overall, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 1 decrease below the 54°F index value, and no changes at other index values at Daguerre Point Dam (Appendix F4, 4 vs. 1, pgs. 224 through 235).

Steelhead juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles.

The discussion of general water temperature changes provided for spring-run Chinook salmon year-round juvenile rearing (see above) applies to the steelhead juvenile rearing life stage. The only difference is that the steelhead juvenile rearing life stage includes slightly different water temperature index values. Water temperatures would generally remain below 65°F, and therefore would remain suitable for steelhead juvenile rearing, throughout the year at Smartville and Daguerre Point Dam. At Marysville, water temperatures r would remain below 65°F for all months of the year with the exceptions of July, August and September. At Marysville during July and August, water temperatures would exceed 65°F about 10 percent of the time, with generally equal occurrences of water temperature increases and decreases under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, when water temperatures exceed 65°F. During September at Marysville, water temperatures would exceed 65°F about 25 percent of the time, with 6 decreases and 2 increases under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, when water temperatures exceed 65°F (Appendix F4, 4 vs. 1, pgs. 371 through 382). Overall, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 3 increases above the 65°F index value, and no change at the 68°F, 72°F or 75°F index values at Daguerre Point Dam (Appendix F4, 4 vs. 1, pgs. 224 through 235). Overall, at Marysville, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 3 increases above the 65°F index value, 6 decreases below the 68°F index value, no changes at the 72°F index value, and 1 increase above the 75°F index value (Appendix F4, 4 vs. 1, pgs. 347 through 358).

The steelhead smolt emigration period is believed to extend from October through May. The discussion of flow and water temperature changes provided for spring-run Chinook salmon smolt emigration (see above) encompasses nearly the entire fall-run Chinook salmon juvenile rearing and outmigration time period. The only differences are that the steelhead smolt emigration period encompasses one additional month (October) and one less month (June), and includes different water temperature index values. During October at Smartville, measurable flow decreases consistently would occur from intermediate to high flow levels, and measurable flow increases consistently occur from low to intermediate flow levels. During October at Marysville, measurable flow decreases would consistently occur at all but the lowest flow levels, at which they would remain generally equivalent (Appendix F4, 4 vs. 1, pgs. 125 through 136 and 297 through 308).

During the steelhead smolt emigration life stage, water temperatures at Smartville during October would always exceed 52°F, yet would generally remain below 56°F under both the CEQA Modified Flow Alternative and the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs.199 through 210). Water temperatures at Daguerre Point Dam would be equivalent over nearly the entire cumulative water temperature distributions in October under both alternatives, and would generally remain below 58°F (Appendix F4, 4 vs. 1, pgs. 248 through 259). At Marysville, water temperatures would generally exceed the water temperature index value of 56°F, with measurable water temperature increases frequently occurring under relatively cool water temperature conditions (about 57 – 59°F) during October under the CEQA

Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 371 through 382).

Overall, during the entire October through May smolt emigration period at Daguerre Point Dam, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition result in 1 increase above the 59°F index value, and no changes at other index values (Appendix F4, 4 vs. 1, pgs. 224 through 235). Overall, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, would result in 1 decrease below the 52°F index value, no changes at the 55°F index value, and 2 increases above the 59°F index value at Marysville (Appendix F4, 4 vs. 1, pgs. 347 through 358).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent or less suitable adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) generally equivalent and suitable water temperatures from November through March; (4) water temperature increases during August and September at intermediate to low water temperature conditions, by contrast to water temperature decreases at warm water temperature conditions (about 59°F to nearly 62°F), when water temperatures are most stressful, at Daguerre Point Dam; and (5) measurable and consistent water temperature increases at nearly all (about 56°F to nearly 66°F) but the warmest water temperature conditions during August, at low to intermediate water temperature conditions (about 59 – 64.5°F) during September, and under relatively low water temperature conditions (about 57 – 59°F) during October at Marysville

- Generally equivalent spawning conditions due to similar spawning habitat availability, and generally equivalent and suitable water temperatures

- Generally equivalent embryo incubation conditions due to similar water temperature conditions during this life stage

- Generally equivalent or improved over-summer rearing conditions due to: (1) similar and suitable water temperatures during most months throughout the lower Yuba River; (2) similar and generally suitable water temperatures during July and August at Marysville, exceeding 65°F about 10 percent of the time; and (3) more frequent measurable water temperature reductions, and therefore more suitable conditions, generally during September at Marysville under relatively warm water temperature conditions (≥ 65°F)

- Generally equivalent smolt emigration conditions due to, in general: (1) measurable flow decreases at intermediate to high flow levels, with measurable flow increases at low to intermediate flow levels from October through January; (2) measurable flow decreases at intermediate flow levels during March, and measurable flow increases at low to intermediate flow levels during April and May at Smartville; (3) at Marysville, consistent and measurable flow decreases at low to intermediate flow levels during March, yet remain above 750 cfs with about a 95 percent probability; at nearly all but the lowest flow levels during April, yet remain above about 500 cfs with an 80 percent probability; and at intermediate to high flow levels (about ≥ 1,550 cfs) during May; and (4) generally equivalent and suitable water temperatures during this life stage

In conclusion, in consideration of potential impacts to all life stages of steelhead, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Yuba River steelhead.

Impact 10.2.6-6: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect green sturgeon

Flows during the green sturgeon immigration and holding (February through July) and adult spawning and embryo incubation (March through July) life stage periods are expected to allow adequate upstream migration and spawning habitat availability, under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Overall, under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, would result in 9 increases above the 61°F index value for adult immigration and holding, 3 decreases below the 68°F index value for adult spawning, and 3 decreases below the 68°F index value for embryo incubation (Appendix F4, 4 vs. 1, pgs. 347 through 358).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juveniles. At Marysville, water temperatures generally would remain below 66°F for all months of the year with the exceptions of July, August and September. At Marysville, water temperatures would exceed 66°F about 10 percent of the time during July, and about 5 percent of the time during August, with generally equal occurrences of water temperature increases and decreases under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, when water temperatures would exceed 66°F. During September at Marysville, water temperatures would exceed 66°F about 25 percent of the time, with 6 decreases and 2 increases under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, when water temperatures would exceed 66°F. Overall, during the year-round green sturgeon juvenile rearing life stage, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 1 decrease below the 66°F index value (Appendix F4, 4 vs. 1, pgs. 347 through 358 and 371 through 382).

The juvenile emigration life stage generally extends from May through September. Similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juvenile emigration. As described in the discussion of the year-round juvenile rearing period, during the warmest months of July, August and September water temperatures under the CEQA Modified Flow Alternative would be generally equivalent, under relatively warm water temperature conditions (≥ 66°F), and therefore would result in generally equivalent juvenile emigration conditions. Overall, the CEQA Modified Flow Alternative would result in 1 decrease below the 66°F index value during the juvenile emigration life stage (Appendix F4, 4 vs. 1, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding, adult spawning and embryo incubation conditions, because of corresponding upstream migration and spawning flow-related habitat availabilities, and slightly lower and therefore more suitable water temperatures during adult immigration and holding
- Generally equivalent over-summer rearing and juvenile emigration conditions, due to generally equivalent water temperatures during relatively warm water temperature conditions at Marysville

In conclusion, in consideration of potential impacts to all life stages of green sturgeon, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Yuba River green sturgeon.

Impact 10.2.6-7: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect American shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Yuba River. Studies conducted on the lower Yuba River suggest that shifting of proportional flows (lower Yuba River flows/lower Feather River flows) may simply re-allocate shad from the Feather River to the lower Yuba River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for American shad attraction into the lower Yuba River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.5 percent lower during April, 0.5 percent lower during May, and 0.9 percent lower during June under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Under the CEQA Modified Flow Alternative, during wet years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.4 percent lower during April, 0.5 percent lower during May, and 0.8 percent lower during June. During above normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.7 percent lower during April, 0.8 percent lower during May, and 1.5 percent lower during June. During below normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.8 percent higher during April, 0.9 percent lower during May, and 1.3 percent lower during June. During dry years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 1.9 percent lower during April, 0.1 percent lower during May, and 0.4 percent lower during June. During critical years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow would be 0.9 percent lower during April, 0.1 percent lower during May, and 0.2 percent higher during June (Appendix F4, 4 vs. 1, pgs. 347 and 726).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Changes in long-term average proportionate flows and average proportionate flows by water year type would not be of sufficient magnitude to substantively affect American shad attraction into the lower Yuba River.

Differences in water temperature between the Feather and lower Yuba rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in 2 additional occurrences (for the 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 4 vs. 1, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would result in a less than significant impact to lower Yuba River American shad.

Impact 10.2.6-8: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Yuba River. Striped bass spawning and initial rearing in the lower Yuba River extends from April through June. Proportionate flow changes resulting from implementation of the CEQA Modified Flow Alternative relative to the CEQA Existing Condition during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Yuba River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Changes in long-term average proportionate flows and average proportionate flows by water year type would not be of sufficient magnitude to substantively affect striped bass attraction into and initial rearing in the lower Yuba River.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in the same number of occurrences (for the 213 months included in the analysis) when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 4 vs. 1, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would result in a less than significant impact to lower Yuba River striped bass.

10.2.6.2 CVP/SWP UPSTREAM OF THE DELTA REGION

FEATHER RIVER BASIN

Oroville Reservoir

Impact 10.2.6-9: Decreases in Oroville Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Reductions in simulated end-of-month water surface elevation in Oroville Reservoir by more than six feet would occur the same number of times from March through June under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition. Therefore, changes in water surface elevations that could occur under the CEQA Modified Flow Alternative would result in a less than significant impact to Oroville Reservoir warmwater fisheries, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 456 through 467).

Impact 10.2.6-10: Decreases in Oroville Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Under the CEQA Modified Flow Alternative, long-term average end of month storage and average storage by water year type would be essentially equivalent from April through November, relative to the CEQA Existing Condition. Therefore, changes in reservoir storage that could occur under the CEQA Modified Flow Alternative would result in a less than significant impact to Oroville Reservoir coldwater fisheries, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pg. 406).

Lower Feather River

The following sections describe and discuss flow and water temperature differences between the CEQA Modified Flow Alternative and the CEQA Existing Condition, and potential effects on fisheries and aquatic resources in the lower Feather River.

Over the entire simulation period for every month of the year, long-term average flows and water temperatures for all water year types, monthly mean flows and water temperatures, and the cumulative flow and water temperature distributions in the Low Flow Channel below the Fish Barrier Dam would be essentially equivalent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Therefore, evaluations of potential effects in the lower Feather River are restricted to below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River (Appendix F4, 4 vs. 1, pgs. 505 through 517 and 554 through 566).

Impact 10.2.6-11: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The analytical period for adult immigration and holding of spring-run Chinook salmon in the lower Feather River extends from March through October. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would be higher by ten percent or more with about 2 and 3 percent probability during September and April, respectively. Simulated flows would be lower by ten percent or more with about 1 percent probability during March and April. Simulated flows below the Thermalito Afterbay Outlet would be essentially equivalent or measurably higher with about 70 to 100 percent probability during all months of this life stage. During relatively low flow conditions, flows would be higher by ten percent or more with about 12 percent probability during April. By contrast, during relatively low flow conditions flows would be lower by ten percent or more with about 4 percent probability during March (Appendix F4, 4 vs. 1, pgs. 604 through 615 and 628 through 639).

Simulated flows at the mouth of the lower Feather River under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would be higher by ten percent or more with about 1 percent probability during July. Simulated flows would be lower by ten percent or more with about 2 and 3 percent probability during July and August, respectively. Simulated flows would be essentially equivalent with about 60 to 75 percent probability from March through June. During July through October, flow decreases would occur with about 60 to 90 percent probability. During relatively low flow conditions, flows would be higher by ten percent or more with about 4 percent probability during July. By contrast, during relatively low flow conditions, flows would be lower by ten percent or more with about 8 and 12 percent probability during July and August, respectively (Appendix F4, 4 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be generally equivalent over the entire cumulative water temperature distributions during the March through October adult immigration and holding life stage period. Under both alternatives, water temperatures always remain below the 60°F index value during March, and remain at or below the 60°F index value with approximately 90 percent probability during April, 60 percent probability during October, with only about a 15 percent probability during May, 1 percent probability during September, and always exceed the 60°F index value from June through August. In fact, water temperatures exceed the 68°F water temperature index value with about 2, 25, 80, 60 and 5 percent probability during May, June, July, August and September, respectively (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be generally equivalent or lower over the entire cumulative water temperature distributions during October, March, April and September. Water temperature increases would occur during May, June, July and August with about 2, 5, 6, and 35 percent probability, respectively. Under both alternatives, water temperatures always remain at or below the 60°F index value with approximately 99 percent probability during March, 40 percent probability during April, 20 percent probability during October, with only about a 1 percent probability during May, and always exceed the 60°F index value from June through September. In fact, under both alternatives, water temperatures exceed the 68°F water temperature index value with about 25, 70 and 85 percent probability during May, June and September, respectively. Water temperatures always exceed 68°F during July and August. During warmer temperature conditions, water temperatures would be measurably higher with about 8 percent probability during May, 16 percent probability during June, 36 percent during July, and 60 percent during August (Appendix F4, 4 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire March through October adult immigration and holding period below the Thermalito Afterbay Outlet, no additional increases above, or decreases below the 60, and 68°F index values would be associated with the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 678 through 689). The CEQA Modified Flow results in 1 increase above the 64°F index value. At the mouth of the Feather

River, the CEQA Modified Flow Alternative results in 2 increases above the 60°F index value. No additional increases above, or decreases below the 64°F and 68°F index values would be associated with the CEQA Modified Flow Alternative (Appendix F4, 4 vs. 1, pgs. 825 through 836).

Because no clear distinction between spring- and fall-run Chinook salmon spawning could be derived from survey data collected in the lower Feather River, the spawning habitat analysis for potential impacts on the two runs was combined into one expanded spawning season (September through December) that was inclusive of all Chinook salmon spawning in the lower Feather River. Over the 71-year simulation period, the annual spawning habitat availability long-term average for Chinook salmon spawning in the lower Feather River under the CEQA Modified Flow Alternative is similar to that under the CEQA Existing Condition (long-term average of 85.3 percent versus 85.2 percent of the maximum WUA) (Appendix F4, 4 vs. 1, pg. 873).

The cumulative annual Chinook salmon spawning habitat availabilities under the CEQA Yuba Accord Alternative would be almost undistinguishable from those under the CEQA Existing Condition. Both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would achieve over 90 percent of maximum WUA with about 25 percent probability, and both alternatives would achieve over 85 percent of maximum WUA with nearly 85 percent probability. Changes of 10 percent or more in annual spawning habitat availability would not occur (Appendix F4, 4 vs. 1, pg. 875).

Water temperatures below the Thermalito Afterbay Outlet during September, which represents the earliest month of the spawning period, would be nearly identical between the CEQA Modified Flow Alternative and the CEQA Existing Condition, and commonly exceed water temperatures reported to be suitable for Chinook salmon spawning. For example, under both alternatives, water temperatures below the Thermalito Afterbay Outlet during September exceed 62°F with about 95 percent probability. Water temperatures under both alternatives also would be essentially equivalent during October, November and December. Under both alternatives during October, water temperatures exceed the reported optimum (56°F) for Chinook salmon spawning about 95 percent of the time, whereas water temperatures remain suitable for spawning during November and December (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 702 through 725).

The embryo incubation life stage for Chinook salmon in the lower Feather River generally extends from September through February. Timing of fry emergence is primarily dependant on water temperature. As indicated above for the spawning life stage, water temperatures below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be nearly identical, to those under the CEQA Existing Condition during the September through December period. During January and February, water temperatures generally do not exceed 53°F, and therefore do not approach the lowest water temperature index value (56°F) below the Thermalito Afterbay Outlet under either the CEQA Modified Flow Alternative or the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 702 through 713).

Long-term average early life stage survival estimates would be identical under the CEQA Modified Flow Alternative and the CEQA Existing Condition (97.7 percent). Early life stage survival estimates do not differ by more than 0.1 percent for any individual year included in the 71-year period of analysis. Substantial reductions in salmon survival over three or more consecutive years would not be observed between the CEQA Modified Flow Alternative and the CEQA Existing Condition. Therefore, the CEQA Modified Flow Alternative is not anticipated to affect potential future recruitment from a given spawning stock, which may in turn affect the population dynamics of subsequent generations (Appendix F4, 4 vs. 1, pg. 881).

Spring-run Chinook salmon juveniles are commonly reported to rear in their natal streams from 9 to 18 months. Specific habitat-discharge relationships for juvenile Chinook salmon rearing have not been developed for the lower Feather River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to Chinook salmon juveniles. Therefore, for impact assessment purposes, year-round examination of water temperatures is conducted to address potential juvenile spring-run Chinook salmon rearing in the lower Feather River.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be essentially equivalent to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. From November through March, water temperatures generally remain below 60°F under both alternatives. Water temperatures during October and April generally remain at or below 65°F, and with about 90 percent probability during May. Water temperatures exceed 65°F with about 75 percent probability during June, about 50 percent probability during September, and always exceed 65°F during July and August. Water temperatures would be considered to be particularly stressful to rearing juvenile Chinook salmon during July and August, when water temperatures under both alternatives exceed about 70°F with nearly 40 and 35 percent probability, respectively. Overall, during the year-round juvenile Chinook salmon rearing life stage below the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, results in no additional increases above, or decreases below, the 60, 63, 65, 68, 70 and 75°F index values (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 702 through 713).

Spring-run Chinook salmon smolt emigration reportedly occurs from October through June. Flows below the Thermalito Afterbay Outlet from October through June would be essentially equivalent or measurably higher with about 70 to 100 percent probability under the CEQA Modified Flow Alternative and the CEQA Existing Condition. Simulated flows below the Thermalito Afterbay Outlet do not change by ten percent or more, with more than about 5 percent probability during any month of the smolt emigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with about 12 percent probability during April, and lower by 10 percent or more with 4 percent probability during March (Appendix F4, 4 vs. 1, pgs. 604 through 615 and 628 through 639).

Flows at the mouth of the lower Feather River would be measurably higher by more than 40 percent of the cumulative flow distribution during December under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Flows from January through June would be essentially equivalent or measurably higher with about 60 to 95 percent probability. Flows during November would be essentially equivalent or measurably higher with about 55 percent probability, and measurably lower with about 45 percent probability. Measurably flow decreases would occur with approximately 65 percent probability during October. However, flow levels remain above 1,500 cfs under both alternatives for nearly the entire cumulative distribution, and remain above 3,000 cfs with approximately 50 percent probability. Simulated flows at the mouth of the Feather River do not change by ten percent or more, with more than about 5 percent probability during any month of the smolt emigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 16 percent probability during January and 8 percent during February (Appendix F4, 4 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be essentially equivalent over the entire cumulative water temperature distributions during the October through June smolt emigration life stage period. Under both alternatives, water temperatures always remain below the 60°F index value from November through March, remain below the 60°F index value with nearly a 60 and 90 percent probability during October and April, respectively, with only about a 15 percent probability during May, and always exceed the 60°F index value during June (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 702 through 713).

At the mouth of the lower Feather River, water temperatures under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be generally below 60°F from November through March. Under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, water temperatures would be generally essentially equivalent for all months of the smolt emigration life stage except for May and June. During May and June, water temperatures would be essentially equivalent with over 95 percent probability, and would be measurably higher with approximately 2 to 4 percent probability. During warmer conditions, water temperatures would be measurably higher with approximately 8 and 16 percent probability during May and June, respectively (Appendix F4, 4 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the spring-run Chinook salmon emigration life stage below the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, results in no additional increases above, or decreases below, the 60, 63, 68 and 70°F index values (Appendix F4, 4 vs. 1, pgs. 678 through 689). At the mouth of the Feather River, the CEQA Modified Flow Alternative, results in 2 and 1 increases above the 60 and 70°F index values, respectively. No additional increases above, or decreases below the 63, and 68°Findex values would be associated with the CEQA Modified Flow Alternative (Appendix F4, 4 vs. 1, pgs. 825 through 836).

Based on instream flow, water temperature, spawning habitat availability and early life stage survival analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative is expected to provide:

- Generally equivalent adult immigration and holding conditions due to: (1) equivalent or measurably higher flows with about 70 to 100 percent probability during all months of this life stage below the Thermalito Afterbay Outlet; (2) essentially equivalent water temperatures over the entire cumulative water temperature distributions during March through October below the Thermalito Afterbay Outlet; and (3) essentially equivalent water temperatures over the entire cumulative water temperature distributions during March through October at the mouth of the Feather River, with measurably higher water temperatures during about 25 percent of the warmest water temperature conditions during August

- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period

- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates

- Equivalent over-summer juvenile rearing conditions due to nearly identical water temperatures below the Thermalito Afterbay Outlet
- Generally equivalent smolt emigration conditions due to: (1) equivalent or measurably higher flows with about 70 to 100 percent probability during all months of this life stage below the Thermalito Afterbay Outlet; and (2) essentially equivalent water temperatures over the entire cumulative water temperature distributions during the March through October below the Thermalito Afterbay Outlet; (3) equivalent or measurably higher flows with about 60 to 95 percent probability during all months of this life stage except for October and November at the mouth of the lower Feather River; (4) during October and November, flow decreases would occur with about 45 to 65 percent probability; however flows remain at 1,500 cfs or more with approximately 80 to 95 percent probability at the mouth of the lower Feather River; and (5) essentially equivalent water temperatures with over 95 percent probability for the entire cumulative water temperature distributions during the March through October at the mouth of the lower Feather River

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River spring-run Chinook salmon.

Impact 10.2.6-12: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The adult immigration and holding life stage for fall-run Chinook salmon in the lower Yuba River primarily extends from July through December. Simulated flows below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would be higher by ten percent or more with 2 percent probability during September. Simulated flows would not be lower by ten percent or more during any month of the fall-run Chinook salmon adult immigration and holding life stage. Simulated flows below the Thermalito Afterbay Outlet would be essentially equivalent or measurably higher with a 70 to 95 percent probability during all months of this life stage. In fact, July flows would be measurably higher with about 90 percent probability. During relatively low flow conditions, flows between the alternatives do not differ by 10 percent or more (Appendix F4, 4 vs. 1, pgs. 628 through 639).

Under the CEQA Modified Flow Alternative, simulated flows at the mouth of the lower Feather River would be higher than the CEQA Existing Condition by ten percent or more with 1 percent probability during July and December. Simulated flows would be lower by ten percent or more with about 2 percent probability during July, and 3 percent probability during August. Simulated flows would be measurably higher with about 40 percent probability during December. November flows would be essentially equivalent or measurably higher with approximately 55 percent probability, and measurably lower with approximately 45 percent probability. Simulated flows would be measurably lower with about 60 to 90 percent probability from July through October; however flows would be higher than 1,500 cfs with over 95 percent probability, and higher than 3,000 cfs with about 50 to 90 percent probability. During relatively low flow conditions, flows would be higher by ten percent or more with about 4 percent probability during July, and lower by 10 percent or more with about 8 percent probability during July and 12 percent probability during August (Appendix F4, 4 vs. 1, pgs. 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet would be essentially equivalent for the CEQA Modified Flow Alternative and the CEQA Existing Condition over the entire cumulative water temperature distributions during the July through December adult immigration and holding life stage period (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be generally equivalent or lower over the entire cumulative water temperature distributions during October, November and September. The CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, results in infrequent increases in water temperature during December; however, water temperatures would be generally equivalent for both alternatives with approximately 95 percent probability. During August, simulated water temperatures would be measurably higher with about 35 percent probability. Under both alternatives, water temperatures always remain below the 60°F during November and December, and approximately with 15 to 20 percent probability during September and October. Simulated water temperatures always exceed 60°F during July and August. In fact, under both alternatives, water temperatures always exceed the 68°F water temperature index value (Appendix F4, 4 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire July thorough December adult immigration and holding period below the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, results in one increase above the 64°F index value, and no additional increases above, or decreases below the 60 and 68°F index values (Appendix G, 4 vs. 1, pg. G-177). At the mouth of the lower Feather River , the CEQA Modified Flow Alternative results in 2 increases above the 60°F index value, and no additional increases above, or decreases below the 64 and 68°F index values (Appendix G, 4 vs. 1, pg. G-178).

The adult spawning and embryo incubation life stage periodicities of fall-run Chinook salmon in the Feather River are not distinguished from those of the spring-run; therefore these life stages are not evaluated separately. For evaluation of Chinook salmon spawning and embryo incubation under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, see the discussion provided above under spring-run Chinook salmon.

The juvenile fall-run Chinook salmon rearing and outmigration period in the lower Feather River extends from November through June. Flows below the Thermalito Afterbay Outlet from November through June would be essentially equivalent or measurably higher with 70 to 100 percent probability under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. For the entire cumulative flow distribution, simulated flows below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, do not change by ten percent or more, with more than about 5 percent probability during any month of the smolt emigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 12 percent probability during April. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with 4 percent probability during March (Appendix F4, 4 vs. 1, pgs. 604 through 615 and 628 through 639).

Flows at the mouth of the lower Feather River would be measurably higher by 50 percent or more of the cumulative flow distribution during December under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Flows from January through June would be essentially equivalent or measurably higher with about 60 to 90 percent probability. Flows during November would be essentially equivalent or measurably higher with about 50 percent probability, and measurable lower also with about 50 percent probability. However, flow levels remain above 1,500 cfs under both alternatives with about 80 percent probability.

For the entire cumulative flow distribution, simulated flows at the mouth of the Feather River do not change by ten percent or more with more 5 percent probability during any month of the juvenile rearing and outmigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with 20 percent probability during January and 8 percent probability during February (Appendix F4, 4 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative and the CEQA Existing Condition would be generally equivalent over the entire cumulative water temperature distributions during the November through June juvenile rearing and outmigration life stage period (Appendix F4, 4 vs. 1, pgs. 677 through 725).

At the mouth of the lower Feather River, water temperatures under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be generally below 60°F from November through March. Under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, water temperatures would be generally measurably equivalent November, January, February, March and April. During December, May and June, water temperatures would be essentially equivalent with over 95 percent probability. During warmer conditions, water temperatures would be measurably higher with approximately 8 and 16 percent probability during May and June, respectively (Appendix F4, 4 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire November through June juvenile rearing and outmigration period below the Thermalito Afterbay Outlet, no additional increases above, or decreases below the 60, 63, 65, 68, 70 and 75°F index values would be associated with the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. At the mouth of the Feather River, the CEQA Modified Flow Alternative results in 1 increase above the 60 and 70°F index values. No additional increases above, or decreases below the 63, 65, 68 and 75°F index values would be associated with the CEQA Modified Flow Alternative (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 825 through 836).

Based on instream flow, water temperature, spawning habitat availability and early life stage survival analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative is expected to provide:

- Generally equivalent adult immigration and holding conditions due to: (1) equivalent or measurably higher flows with about 70 to 95 percent probability during all months of this life stage below the Thermalito Afterbay Outlet; (2) simulated water temperatures would be generally equivalent over the entire cumulative water temperature distributions during July through December below the Thermalito Afterbay Outlet; (3) slight but measurably lower flows during most months of this life stage at the mouth of the lower Feather River; (4) frequent measurable water temperatures increases during August at the mouth of the lower Feather River; and (5) essentially equivalent water temperatures over the entire cumulative water temperature distributions during July through December at the mouth of the Feather River, with measurably higher water temperatures during about 25 percent of the warmest water temperature conditions during August

- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period
- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates
- Generally equivalent juvenile rearing and outmigration conditions due to: (1) generally equivalent or measurably higher flows from November through June with about 70 to 100 percent probability below the Thermalito Afterbay Outlet; (2) generally equivalent water temperatures from November through June below the Thermalito Afterbay Outlet; (3) generally equivalent flow conditions from November through June at the mouth of the lower Feather River; and (4) essentially equivalent water temperatures from November through June at the mouth of the lower Feather River

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River fall-run Chinook salmon.

Impact 10.2.6-13: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the lower Feather River extends from August through April. Simulated flows below the Thermalito Afterbay Outlet would be higher by ten percent or more with about 2 percent probability during September and 3 percent during April. Simulated flows would be lower by ten percent or more with about 1 percent probability during January, March and April. Simulated flows would be essentially equivalent or measurably higher with a 70 to 95 percent probability during all months of this life stage. During relatively low flow conditions, flows would be higher by ten percent or more with about 12 percent probability during April, and lower by ten percent or more with about 4 percent probability during March (Appendix F4, 4 vs. 1, pgs. 604 through 615 and 628 through 639).

Simulated flows at the mouth of the lower Feather River would be higher by ten percent or more with about 1, 4 and 3 percent probability during December, January and February, respectively. Simulated flows would be lower by ten percent or more with about 3 percent probability during August. During December, simulated flows would be measurably higher with a 40percent probability. Simulated flows would be essentially equivalent or measurably higher with a 75 to 90 percent probability during January through April. During November, flows would be essentially equivalent or higher with about 55 percent probability, and measurably lower with about 45 percent probability. During August through October, flows would be measurably lower with about a 60 to 90 percent probability. However, flow levels remain above 1,500 cfs under both alternatives with over 95 percent probability, and remain at or above 3,000 cfs with about 50 to 80 percent probability. During relatively low flow conditions, flows would be higher by ten percent or more with about 16 percent probability during January, and 8 percent probability during February. Flows would be lower by ten percent or more during relatively low flow conditions with about 12 percent probability during August (Appendix F4, 4 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be essentially equivalent over the entire cumulative water temperature distributions during the August through April adult immigration and holding life stage period (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be generally equivalent over the entire cumulative water temperature distributions for all of the months comprising the adult immigration and holding life stage, except for the month of August. During August, water temperatures would be measurably higher with approximately 35 percent probability. Moreover, during relatively warm water temperatures, the CEQA Modified Flow Alternative results in measurably higher August water temperatures with approximately 60 percent probability. Under both alternatives, water temperatures generally exceed the 56°F index value during August, September, October and April. In fact, water temperatures under both alternatives exceed the 70°F index value with about 80 and 55 percent probability during August and September, respectively. Under both alternatives, water temperatures generally remain below 56°F during November through February, and remain below 56°F with about 75 percent probability during March (Appendix F4, 4 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire August through April adult immigration and holding period below the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, results in no additional increases above, or decreases below the 52, 56 and 70°F index values (Appendix F4, 4 vs. 1, pgs. 678 through 725). At the mouth of the Feather River, the CEQA Modified Flow Alternative results in no additional increases above, or decreases below the 52 and 56°F index values, and 1 additional increase above the 70°F index value (Appendix G, 4 vs. 1, pg. G-178).

The primary analytical period for steelhead spawning extends from December through March. Over the 72-year simulation period, the annual spawning habitat availability long-term average for steelhead in the lower Feather River under the CEQA Modified Flow Alternative is 0.5 percent lower that the CEQA Existing Condition (long-term average of 38 versus 38.5 percent of the maximum WUA) (Appendix F4, 4 vs. 1, pg. 876).

The cumulative annual steelhead spawning habitat availabilities under the CEQA Modified Flow Alternative would be somewhat lower than those under the CEQA Existing Condition. Both the CEQA Modified Flow Alternative and the CEQA Existing Condition achieve over 90 percent of maximum WUA with about 10 percent probability. Changes of 10 percent or more in annual spawning habitat availability only would occur with 1 percent probability (Appendix F4, 4 vs. 1, pg. 878).

Under the CEQA Modified Flow Alternative, water temperatures below the Thermalito Afterbay Outlet during the December through March steelhead spawning period would be essentially equivalent to water temperatures under the CEQA Existing Condition. Water temperatures below the Thermalito Afterbay Outlet during the December through May embryo incubation period also would be essentially equivalent to water temperatures under the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 678 through 689).

Steelhead are commonly reported to rear in their natal streams year round for up to two years. Specific habitat-discharge relationships for juvenile steelhead rearing have not been developed for the lower Feather River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles. Therefore, for impact assessment purposes, year-round examination of water temperatures is conducted to address potential impacts to juvenile steelhead rearing in the lower Feather River.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be essentially equivalent to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 702 through 713).

Steelhead smolt emigration reportedly occurs from October through May. Flows below the Thermalito Afterbay Outlet from October through May would be essentially equivalent or measurably higher with approximately 70 to 100 percent probability under the CEQA Modified Flow Alternative and the CEQA Existing Condition. Simulated flows below the Thermalito Afterbay Outlet do not change by ten percent or more, with more than about 5 percent probability during any month of the smolt emigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 12 percent probability during April. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with 4 percent probability during March (Appendix F4, 4 vs. 1, pgs. 604 through 615 and 628 through 639).

Flows at the mouth of the lower Feather River would be measurably higher by more than 40 percent of the cumulative flow distribution during December under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Flows during November would be essentially equivalent or measurably higher with about 55 percent probability, and would be measurably lower with about 45 percent probability. Flows during January through May would be essentially equivalent or measurably higher with about 75 to 90 percent probability Measurably flow decreases would occur with approximately a 65 percent probability during October; however, flow levels under both alternatives remain above 1,500 cfs with about 95 percent probability, and remain above 3,000 cfs with approximately 50 percent probability. Flows at the mouth of the Feather River do not change by ten percent or more, with more than about 5 percent probability during any month of the smolt emigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 16 and 8 percent probability during January and February, respectively (Appendix F4, 4 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be essentially equivalent over the entire cumulative water temperature distributions during the October through May smolt emigration life stage period (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 702 through 713).

At the mouth of the lower Feather River, water temperatures under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would be generally below 52°F during December and January. Under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, water temperatures would be generally measurably equivalent or lower during every month of the steelhead smolt emigration life stage period, except for December and May. During December, water temperatures would be essentially equivalent with approximately 99 percent probability, and would be measurably higher with approximately 1 percent probability. Moreover, as previously discussed, water temperatures during December would be below 52°F. May water temperatures would be essentially equivalent with approximately 98 percent probability, and would be measurably higher with approximately 2 percent probability. During warmer conditions, water temperatures would be measurably higher with approximately 8 percent probability during May (Appendix F4, 4 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire October through May steelhead smolt emigration period below the Thermalito Afterbay Outlet, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, do not result in additional increases above, or decreases below the 52, 55 and 59°F index values (Appendix F4, 4 vs. 1, pgs. 678 through 689). At the mouth of the Feather River, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, results in 1 increase above the 55°F index value, and no additional increase above, or decrease below the 52 and 59°F index values (Appendix F4, 4 vs. 1, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would be expected to provide:

- Generally equivalent adult immigration and holding conditions due to: (1) equivalent or measurably higher flows ranging from 70 percent to 95 percent of the time during all months of this life stage below the Thermalito Afterbay Outlet; (2) essentially equivalent water temperatures over the entire cumulative water temperature distributions during August through April below the Thermalito Afterbay Outlet; (3) essentially equivalent water temperatures over the entire cumulative water temperature distributions during August through April at the mouth of the Feather River, with measurably higher water temperatures during about 25 percent of the warmest water temperature conditions during August

- Equivalent spawning conditions due to similar spawning habitat availability during the December through April adult spawning period

- Equivalent rearing conditions due to essentially equivalent water temperatures below the Thermalito Afterbay Outlet

- Generally equivalent smolt emigration conditions due to: (1) equivalent or measurably higher flows ranging from 70 percent to 100 percent of the time during all months of this life stage below the Thermalito Afterbay Outlet; (2) essentially equivalent water temperatures over the entire cumulative water temperature distributions during October through May below the Thermalito Afterbay Outlet; (3) essentially equivalent or measurably higher flows ranging from 75 percent to 95 percent of the time during all months of this life stage except for October and November at the mouth of the lower Feather River; (4) measurably lower flows with about 45 to 65 percent probability during October and November, although flows under both alternatives remain above 1,500 cfs with about 80 to 95 percent probability at the mouth of the lower Feather River; and (5) essentially equivalent water temperatures with over 95 percent probability during October through May at the mouth of the lower Feather River

In conclusion, in consideration of potential impacts to all life stages of steelhead, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River steelhead.

Impact 10.2.6-14: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect green sturgeon

The analytical period for green sturgeon adult immigration and holding extends from February through July. Under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, simulated flows below the Thermalito Afterbay Outlet would be essentially equivalent or measurably higher with 90 to 100 percent probability during all months of this life stage (Appendix F4, 4 vs. 1, pgs. 604 through 615).

Under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, simulated flows at Shanghai Bench would be essentially equivalent or measurably higher with 70 to 90 percent probability during February, March and May. Simulated flows would be essentially equivalent or higher with 55 percent probability and measurably lower with 45 percent probability during April and June. During July, simulated flows would be measurably lower with about 90 percent probability; however, flows remain above 1,500 cfs during the entire cumulative flow distribution, and above 3,000 cfs with about 90 percent probability (Appendix F4, 4 vs. 1, pgs. 727 through 738 and 751 through 762).

Under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, simulated flows at the mouth of the lower Feather River would be essentially equivalent or measurably higher with 60 to 80 percent probability during February through June. During July, simulated flows would be measurably lower with about 95 percent probability; however, flows remain above 1,500 cfs with over 95 percent probability, and above 3,000 cfs about 90 percent probability (Appendix F4, 4 vs. 1, pgs. 776 through 787 and 800 through 811).

Because the analytical period for green sturgeon spawning (i.e., March through July) falls within the adult immigration and holding analytical period, flows under the CEQA Modified Flow Alternative below the Thermalito Afterbay Outlet, relative to the CEQA Existing Condition, also would be expected to provide similar conditions for the spawning life stage.

Relative to the CEQA Existing Condition, water temperatures under the CEQA Modified Flow Alternative would be expected to provide generally similar conditions during the adult immigration and holding, spawning, and embryo incubation life stages. Infrequent water temperatures increases would occur during May and June at the mouth of the lower Feather River; however water temperatures would be generally equivalent with about 95 percent probability, and would be measurably higher with nearly 5 percent probability. During warmer conditions, water temperatures at the mouth of the lower Feather River would be measurably higher with about 8 and 16 percent probability during May and June, respectively. During the adult immigration and holding life stage at the Thermalito Afterbay Outlet and at the mouth of the lower Feather River, the CEQA Modified Flow Alternative results in no additional increases above, or decreases below the 61°F index value. During the adult spawning and embryo incubation life stages, which would occur at the Thermalito Afterbay Outlet, but not at the mouth of the Feather River, the CEQA Modified Flow Alternative does not result in additional increases above, or decreases below the 68°F index value (Appendix F4, 4 vs. 1, pgs. 678 through 689 and 825 through 836).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Year-round flows below Thermalito Afterbay, and at the mouth of the lower Feather River have been generally described above under the spring-run Chinook salmon, fall-run Chinook salmon, and steelhead life stage evaluations. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Feather River. In general, available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juveniles.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA Modified Flow Alternative would be generally essentially equivalent to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period (Appendix F4, 4 vs. 1, pgs. 702 through 713).

Simulated water temperature conditions at the mouth of the lower Feather River under the CEQA Modified Flow Alternative would be generally essentially equivalent to those under the CEQA Existing Condition over the entire cumulative water temperature distributions from September through April. During May through July, water temperatures would be essentially equivalent with about 95 percent probability. During August, water temperature would be measurably higher with about 35 percent probability. From October through April, water temperatures generally remain below 66°F under both alternatives. Water temperatures during May and June remain at or below 66°F with about 50 and 10 percent probability, respectively. Water temperatures always exceed 66°F during July, August and September. During warmer conditions, water temperature would be measurably higher with about 8, 16, 24 and 60 percent probability during May, June, July and August, respectively. Nevertheless, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, actually results in two decreases below the 66°F index value (Appendix F4, 4 vs. 1, pgs. 849 through 860).

The juvenile emigration life stage generally extends from May through September. Trends in flows during this life stage are encompassed in the description above for spring-run Chinook salmon adult immigration and holding. Similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juvenile emigration. Because the analytical period for green sturgeon rearing falls within the juvenile rearing analytical period for this species, water temperatures under the CEQA Modified Flow Alternative below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River, relative to the CEQA Existing Condition, also would be expected to provide similar conditions for the juvenile emigration life stage.

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative is expected to provide:

- Generally equivalent adult immigration and holding, adult spawning and embryo incubation conditions because of corresponding upstream migration and spawning flow-related habitat availabilities, and generally suitable water temperatures during adult immigration and holding
- Generally equivalent or slightly less suitable over-summer rearing and juvenile emigration conditions below the Thermalito Afterbay Outlet due to nearly identical water temperatures, and essentially equivalent water temperatures over the entire cumulative water temperature distributions during all months of the year at the mouth of the Feather River, with the exception of August, during which measurably higher water temperatures would occur during about 25 percent of the warmest water temperature conditions

In conclusion, in consideration of potential impacts to all life stages of green sturgeon, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River green sturgeon.

Impact 10.2.6-15: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect American Shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Feather River. As discussed above for lower Yuba River American shad, shifting of proportional flows (lower Feather River flows/Sacramento River flows) may simply re-allocate shad from the Sacramento River to the lower Feather River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for American shad attraction into the lower Feather River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Feather River flow, measured at its mouth, to Sacramento River flow, measured downstream of its confluence with the Feather River, is 0.1 percent lower during April, 0.2 percent lower during May, and 0.2 percent lower during June under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Under the CEQA Modified Flow Alternative, during wet years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.1 percent lower during April, 0.2 percent lower during May, and 0.2 percent lower during June. During above normal years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.2 percent lower during April, 0.2 percent lower during May, and 0.5 percent lower during June. During below normal years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.1 percent higher during April, 0.3 percent lower during May, and 0.1 percent lower during June. During dry years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.2 percent lower during April and 0.2 percent lower during June, with no change during May. Similarly, during critical years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.1 percent lower during April and 0.1 percent lower during June, with no change during May (Appendix F4, 4 vs. 1, pgs. 775 and 882).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. The slightly lower proportionate flows in May and June would not be expected to significantly affect American shad attraction into the lower Feather River because differences in proportionate flows do not exceed 1 percent during any water year type.

Differences in water temperature between the Sacramento and lower Feather rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition results in neither additional or fewer occurrences (for the 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Feather River mouth (Appendix F4, 4 vs. 1, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would be expected to result in less than significant impacts to lower Feather River American shad.

Impact 10.2.6-16: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Feather River. Striped bass spawning and initial rearing in the lower Feather River extends from April through June. Proportionate flow changes resulting from implementation of the CEQA Modified Flow Alternative relative to the CEQA Existing Condition during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Feather River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. The lower proportionate flows in May through June would not be expected to significantly affect striped bass attraction into, and spawning and initial rearing in the lower Feather River because differences in proportionate flows do not exceed 1 percent during any water year type.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition results in 1 additional occurrence (for the 213 months included in the analysis) when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at Feather River mouth (Appendix F4, 4 vs.1, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would be expected to result in less than significant impacts to lower Feather River striped bass.

Impact 10.2.6-17: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail spawning, embryo incubation, and initial rearing life stages in the lower Feather River occur from February through May. Over the entire 72-year period of simulated February through May estimates of usable flooded area (UFA), long-term average UFA in the lower Feather River would be 0.1 percent lower under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, with average estimates of UFA by water year type ranging from 0 percent during below normal and critical years to 0.1 percent lower during the wet, above normal and dry years. Changes of 10 percent or more in UFA would not occur over more than 10 percent of the cumulative UFA distributions (Appendix F4, 4 vs. 1, pgs. 879 through 880).

Over the entire 71-year simulation period, February through May monthly mean water temperatures below the Thermalito Afterbay Outlet, under both the CEQA Modified Flow Alternative and CEQA Existing Condition remain within the 45 - 75°F range of water temperatures reported to be suitable for splittail spawning (Appendix F4, 4 vs. 1, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would be expected to result in less than significant impacts to lower Feather River splittail.

SACRAMENTO RIVER BASIN

Sacramento River

The following sections describe and discuss flow and water temperature differences between the CEQA Modified Flow Alternative and the CEQA Existing Condition, and potential effects on fisheries and aquatic resources in the Sacramento River immediately downstream of the Feather River confluence and at Freeport.

Model output demonstrates relatively minor, but measurable changes in flows the Sacramento River downstream of the Feather River confluence. For example, over the 864 months simulated for the Sacramento River both immediately below the Feather River confluence and at Freeport, no monthly mean flows indicate that a 10 percent or greater change under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 883 through 894 and 1006 through 1017). The cumulative flow distributions for the CEQA Modified Flow Alternative and the CEQA Existing Condition display generally equivalent flows from November through June, as well as during September, slight (< 3 percent) flow decreases at intermediate flow levels during October, and slight (generally < 3 percent) but frequent flow decreases during July and August (Appendix F4, 4 vs. 1, pgs. 907 through 918). Similar results are evident in the Sacramento River at Freeport (Appendix F4, 4 vs. 1, pgs. 1030 through 1041).

Water temperatures in the Sacramento River immediately downstream of the Feather River confluence would be nearly identical under the CEQA Modified Flow Alternative and the CEQA Existing Condition during all months of the year. In fact, measurable (> 0.3°F) water temperature increases would occur only twice, and measurable water temperature decreases would only occur three times out of the 852 months simulated below the Feather River confluence, under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 957 through 968). Similarly, at Freeport, water temperatures would be nearly identical under both alternatives during all months under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 1055 through 1066).

Impact 10.2.6-18: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect winter-run Chinook salmon

The winter-run Chinook salmon adult immigration and holding life stage occurs in the Sacramento River from December through July. The flow and water temperature differences between the CEQA Modified Flow Alternative and the CEQA Existing Condition, described above, would not be expected to substantially affect the Sacramento River winter-run Chinook salmon adult immigration and holding life stage because:

- Only relatively minor and infrequent changes in flows, and nearly identical water temperatures would occur at the lower feather River confluence and at Freeport;

- Overall, for the 568 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition results in 1 increase above the 60°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any water temperature index value at Freeport (Appendix F4, 4 vs. 1, pgs. 957 through 968 and 1055 through 1066).

The juvenile rearing and outmigration life stage extends from June through April. Only relatively minor and infrequent changes in flows, and nearly identical water temperatures would occur at the lower Feather River confluence and at Freeport, which would not be expected to substantively affect juvenile rearing and outmigration (Appendix G, 4 vs. 1, pg. G-186). Overall, for the 781 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition results in 1 increase above the 60°F index value immediately downstream of the Feather River confluence, and in no additional increases above or decreases below any water temperature index value at Freeport (Appendix F4, 4 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of winter-run Chinook salmon, the CEQA Modified Flow Alternative would result in a less than significant impact to winter-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.6-19: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

Spring-run Chinook salmon adult immigration and holding extends from February through September. As discussed above, only relatively minor and infrequent changes in flows, and nearly identical water temperatures would occur at the lower Feather River confluence and at Freeport, which would not be expected to substantively affect adult immigration and holding (Appendix G, 4 vs. 1, pg. G-188). Overall, immediately downstream of the Feather River confluence, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value, and no increases above or decreases below any of the water temperature index values at Freeport (Appendix F4, 4 vs. 1, pgs. 957 through 968 and 1055 through 1066).

Juvenile rearing occurs year-round in the lower Feather River. Overall, for the 852 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition results in 1 increase above the 60°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the juvenile rearing water temperature index values at Freeport. Smolt emigration occurs from October through June. Similarly, for the 639 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition results in 1 increase above the 60°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the smolt emigration water temperature index values at Freeport. Based on the flow and water temperature modeling results described above, the relatively minor changes that would occur in flows and nearly identical water temperatures would not be expected to substantially affect spring-run Chinook salmon juvenile rearing and smolt emigration (Appendix F4, 4 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of spring-run Chinook salmon, the CEQA Modified Flow Alternative would result in a less than significant impact to spring-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.6-20: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

Fall-run Chinook salmon adult immigration and holding extends from July through December. Overall, for the 426 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition results in no additional increases above, or decreases below any of the adult immigration and holding water temperature index values, both immediately downstream of the Feather River confluence and at Freeport. Juvenile rearing and outmigration extends from December through June. For the 497 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition results in 1 increase above the 60°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the juvenile rearing and outmigration water temperature index values at Freeport (Appendix F4, 4 vs. 1, pgs. 957 through 968 and 1055 through 1066).

Based on the flow and water temperature modeling results described above, the relatively minor changes that would occur in flows and nearly identical water temperatures that would occur under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not be expected to substantially affect fall-run Chinook salmon adult immigration and holding, or juvenile rearing and outmigration (Appendix F4, 4 vs. 1, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of fall-run Chinook salmon, the CEQA Modified Flow Alternative would result in a less than significant impact to fall-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.6-21: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect late fall-run Chinook salmon

Late fall-run Chinook salmon adult immigration and holding extends from October through April. Overall, for the 497 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the adult immigration and holding water temperature index values at Freeport. Juvenile rearing and outmigration extends from April through December. For the 639 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value immediately downstream of the Feather River confluence, and in no additional increases above or decreases below any of the juvenile rearing and outmigration water temperature index values at Freeport (Appendix F4, 4 vs. 1, pgs. 957 through 968 and 1055 through 1066).

Based on the flow and water temperature modeling results described above, the relatively minor changes that would occur in flows and nearly identical water temperatures that would occur under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not be expected to substantially affect late fall-run Chinook salmon adult immigration and holding, or juvenile rearing and outmigration (Appendix F4, 4 vs. 1, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of late fall-run Chinook salmon, the CEQA Modified Flow Alternative would result in a less than significant impact to late fall-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.6-22: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect steelhead

In the Sacramento River, the steelhead adult immigration and holding life stage period extends from August through March, the juvenile rearing life stage occurs year-round, and the smolt emigration life stage extends from October through May. Overall, immediately downstream of the Feather River confluence and at Freeport, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition results in no increases above or decreases below any of the steelhead water temperature index values (Appendix F4, 4 vs. 1, pgs. 957 through 968 and 1055 through 1066).

Based on the flow and water temperature modeling results described above, the relatively minor changes that would occur in flows and nearly identical water temperatures that would occur under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not be expected to substantially affect steelhead adult immigration and holding, juvenile rearing, or smolt emigration (Appendix F4, 4 vs. 1, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of steelhead, the CEQA Modified Flow Alternative would result in a less than significant impact to steelhead, relative to the CEQA Existing Condition.

Impact 10.2.6-23: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect green sturgeon

Green sturgeon adult immigration and holding extends from February through July, adult spawning and embryo incubation extend from March through July, juvenile rearing occurs year-round, and juvenile emigration occurs May through September. As discussed above, the relatively minor changes that would occur in flows and nearly identical water temperatures that would occur under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not be expected to substantially affect these green sturgeon life stages. Additionally, no changes would occur across any water temperature index value for any green sturgeon life stage in the Sacramento River immediately downstream of the Feather River confluence or at Freeport (Appendix F4, 4 vs. 1, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of green sturgeon, the CEQA Modified Flow Alternative would result in a less than significant impact to green sturgeon, relative to the CEQA Existing Condition.

Impact 10.2.6-24: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect American shad

American shad adult immigration and spawning extends from April through June. Based on the flow and water temperature modeling results under the CEQA Modified Flow Alternative relative to the No Project Alternative discussed above, the relatively minor changes in flows and nearly identical water temperatures would not be expected to substantially affect American shad adult immigration and spawning. Additionally, for the 213 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F water temperature index value immediately downstream of the Feather River confluence (Appendix F4, 4 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the CEQA Modified Flow Alternative would result in a less than significant impact to American shad, relative to the CEQA Existing Condition.

Impact 10.2.6-25: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect striped bass

Striped bass adult spawning, embryo incubation and initial rearing extend from April through June. Based on the flow and water temperature modeling results under the CEQA Modified Flow Alternative relative to the No Project Alternative discussed above, the relatively minor changes in flows and nearly identical water temperatures would not be expected to substantially affect striped bass adult spawning, embryo incubation and initial rearing. Additionally, for the 213 months included in the analysis, the CEQA Modified Flow Alternative relative to the CEQA Existing Condition results in no increases above or decreases below the 59°F and 68°F water temperature index values, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 4 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the CEQA Modified Flow Alternative would result in a less than significant impact to striped bass, relative to the CEQA Existing Condition.

Impact 10.2.6-26: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail adult spawning, embryo incubation and initial rearing extend from February through May. Over the 72-year simulation period, the frequency with which the Yolo Bypass floodplains were inundated with Sacramento River water is the same under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition. In the Sacramento River immediately downstream of the lower Feather River confluence, for the 288 months included in the analysis, the CEQA Modified Flow Alternative would provide one additional month with monthly mean flows greater than 56,000 cfs. These results suggest that the availability of splittail spawning, egg incubation, and initial rearing habitat would be essentially the same under the CEQA Modified Flow Alternative and the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 883 through 894).

Over the 72-year simulation period, the February through May monthly mean water temperatures on the Sacramento River immediately downstream of the lower Feather River confluence under both the CEQA Modified Flow Alternative and the CEQA Existing Condition would always be within the suitable range (i.e., 45°F to 75°F) for splittail spawning (Appendix F4, 4 vs. 1, pgs. 957 through 968).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the CEQA Existing Condition, the CEQA Modified Flow Alternative would result in a less than significant impact to Sacramento splittail.

10.2.6.3 DELTA REGION

The evaluation of biological impacts on delta fisheries resources and their habitats use parameters established by the USFWS, CDFG, NMFS and others, including X2 locations, Delta outflows and E/I ratios, presented below.

X2 LOCATION

Over the entire 72-year period of simulated X2 locations, long-term average X2 locations would range from 0.1 km higher during August and September to 0.1 km lower during March under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Under the CEQA Modified Flow Alternative, average X2 location by water year type ranges from 0.1 km higher during November, February, April, June, and August to no change during other months in wet years; 0.1 km higher during October, December, and June through September to no change during November and January through May in above normal years; 0.1 km higher during October, November, August, and September to 0.2 km lower during February in below normal years; 0.1 km higher during October, November, May, and July through September to 0.1 km lower during February and March in dry years; and 0.1 km higher during October, December, and January to no change during November and February through September in critical years (Appendix F4, 4 vs. 1, pg. 1189).

Cumulative distributions of X2 location for the CEQA Modified Flow Alternative and the CEQA Existing Condition generally overlap during each month of the year, indicating that the X2 location under each scenario would be downstream of compliance points in the Delta with nearly equal probabilities. Monthly mean X2 location does not change by 1.0 km or more (Appendix F4, 4 vs. 1, pgs. 1214 through 1225)

Over the entire 72-year simulation period during the delta smelt spawning season (February through June), the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, does not result in a 0.5 km or greater upstream or downstream shift while X2 is located between Chipps Island and the Confluence compliance points during any of the 360 months included in the analysis (Appendix F4, 4 vs. 1, pgs. 1190 through 1201).

DELTA OUTFLOW

Over the entire 72-year period of simulated Delta outflow, long-term average Delta outflow ranges from no change during October through June and September, to 1 percent lower during July and August, under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition. Under the CEQA Modified Flow Alternative, average Delta outflow by water year type: does not change during any month with the exception of July, which is 1 percent lower in wet years; ranges from no change during October through May and September, to 2 percent lower during August in above normal years; ranges from 1 percent higher during January, to 1 percent lower during July and August in below normal years; ranges from 1 percent higher during December and January, to 1 percent lower during July through September in dry years; and does not change during any month in critical years (Appendix F4, 4 vs. 1, pg. 1140).

Over the 72-year period of simulation the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, results in increases in the percentages of Delta outflow of 5 percent or more in 9 out of 864 months included in the analysis, and decreases of 5 percent or more in 1 out of 864 months (Appendix F4, 4 vs. 1, pgs. 1141 through 1152).

EXPORT-TO-INFLOW RATIO

Delta E/I ratio limits are built into the CALSIM modeling assumptions and, therefore, are consistently met under both the Proposed Action and Environmental Baseline during all months of the year. Over the entire 72-year period of simulated E/I ratios, long-term average E/I ratios do not change during any month under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pg. 1238). Under the CEQA

Modified Flow Alternative, average E/I ratio by all water year types also does not change during any month with the exception of July during wet and above normal years, which would be 1 percent lower. Over the 72-year period of simulation the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, results in a maximum increase of 2 percent, and a maximum decrease of 3 percent in the E/I ratios during any month included in the analysis (Appendix F4, 4 vs. 1, pgs. 1239 through 1250).

SALVAGE ESTIMATION

Delta Smelt

The combined overall estimated salvage for delta smelt at the CVP and SWP salvage facilities decreases by 0.4 percent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type changes by: (1) 0.2 percent decrease during wet years; (2) 1.0 percent decrease during above normal years; (3) 0.2 percent decrease during below normal years; (4) 0.5 percent decrease during dry years; and (5) 0.1 percent decrease during critical years, under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pg. 1336).

Winter-run Chinook Salmon

The combined overall estimated salvage for winter-run Chinook salmon at the CVP and SWP salvage facilities decreases by 0.1 percent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type changes by: (1) 0.1 percent decrease during wet years; (2) no change during above normal and below normal years; (3) 0.2 percent decrease during dry and critical years, under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pg. 1324).

Spring-run Chinook Salmon

The combined overall estimated salvage for spring-run Chinook salmon at the CVP and SWP salvage facilities decreases by 0.1 percent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type changes by: (1) 0.1 percent decrease during wet and above normal years; (2) no change during below normal years; (3) 0.1 percent decrease during dry years; and (4) no change during critical years, under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pg. 1324).

Steelhead

The combined overall estimated salvage for steelhead at the CVP and SWP salvage facilities decreases by 0.1 percent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type changes by: (1) 0.1 percent decrease during wet years; (2) no change during above normal years; (3) 0.1 percent decrease during below normal and dry years; (4) 0.2 percent decrease during critical years, under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pg. 133).

Striped Bass

The combined overall estimated salvage for striped bass at the CVP and SWP salvage facilities decreases by 1.1 percent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type changes by: (1) 1.2 percent decrease during wet years; (2) 2.1 percent decrease during above normal years; (3) 0.7 percent decrease during below normal years; (4) 0.6 percent decrease during dry years; and (5) 0.3 percent decrease during critical years, under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 1334 through 1335).

Impact 10.2.6-27: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect delta smelt

Model results indicate no additional 0.5 km upstream or downstream movements in the location of X2 while X2 is located between Chipps Island and the Confluence compliance points in response to implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, as described above.

Changes in monthly mean outflow in the Delta, as well as the E/I ratio, would be relatively infrequent and of minor magnitude under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. In addition, overall delta smelt estimated salvage at the CVP and SWP facilities decreases by 0.4 percent, and decreases during every water year type from 0.1 to 1.0 percent, under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated delta smelt salvage, the CEQA Modified Flow Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to delta smelt (Appendix F4, 4 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.6-28: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect winter-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect winter-run Chinook salmon habitat. In addition, overall estimated winter-run Chinook salmon salvage at the CVP and SWP facilities decreases by 0.1 percent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated winter-run Chinook salmon salvage, the CEQA Modified Flow Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to winter-run Chinook salmon (Appendix F4, 4 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.6-29: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect spring-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect spring-run Chinook salmon habitat. In addition, overall estimated spring-run Chinook salmon salvage at the CVP and SWP facilities decreases by 0.1 percent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated spring-run Chinook salmon salvage, the CEQA Modified Flow Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to spring-run Chinook salmon (Appendix F4, 4 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.6-30: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect steelhead

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect steelhead habitat. In addition, overall estimated steelhead salvage at the CVP and SWP facilities decreases by 0.1 percent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated steelhead salvage, the CEQA Modified Flow Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to steelhead (Appendix F4, 4 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.6-31: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect striped bass

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect striped bass habitat. In addition, overall estimated striped bass salvage at the CVP and SWP facilities decreases by 1.1 percent under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated striped bass salvage, the CEQA Modified Flow Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to striped bass (Appendix F4, 4 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.6-32: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) could affect other Delta fisheries resources

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, as described above under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect other Delta fisheries resources habitats. In conclusion, the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to other Delta fisheries resources (Appendix F4, 4 vs. 1, pgs. 1140, 1189, and 1238).

10.2.6.4 *Export Service Area*

San Luis Reservoir

Impact 10.2.6-33: Decreases in San Luis Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Simulated decreases in water surface elevation by more than 6 feet per month occurs the same number of times during March through June under the CEQA Modified Flow Alternative relative to the CEQA Existing Condition. Therefore, changes in water surface elevations that could occur under the CEQA Modified Flow Alternative would result in a less than significant impact to San Luis Reservoir warmwater fisheries, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 1438 through 1449).

Impact 10.2.6-34: Decreases in San Luis Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Long-term average end of month storage and average storage by water year type under the CEQA Modified Flow Alternative would not change during any month in any year type relative to the CEQA Existing Condition. Therefore, changes in reservoir storage that could occur under the CEQA Modified Flow Alternative would result in a less than significant impact to San Luis Reservoir coldwater fisheries, relative to the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs. 1339 through 1376).

10.2.7 Environmental Impacts/Environmental Consequences of the CEQA No Project/NEPA No Action Alternative Compared to the CEQA Existing Condition/NEPA Affected Environment

As discussed in Chapter 3, the key elements and activities (e.g., implementation of the RD-1644 Long-term instream flow requirements) for the CEQA No Project Alternative would be the same for the NEPA No Action Alternative. The primary differences between the CEQA No Project and NEPA No Action alternatives are various hydrologic and other modeling assumptions (see Section 4.5 and Appendix D). Because of these differences between the No Project and No Action alternatives, these alternatives are distinguished as separate alternatives for CEQA and NEPA evaluation purposes.

Based on current plans and consistent with available infrastructure and community services, the CEQA No Project Alternative in this EIR/EIS is based on current environmental conditions (e.g., project operations, water demands, and level of land development) plus potential future operational and environmental conditions (e.g., implementation of the RD-1644 Long-term instream flow requirements in the lower Yuba River) that probably would occur in the foreseeable future in the absence of the Proposed Project/Action or another action alternative. The NEPA No Action Alternative also is based on conditions without the proposed project, but uses a longer-term future timeframe that is not restricted by existing infrastructure or physical and regulatory environmental conditions. The differences between these modeling characterizations and assumptions for the CEQA No Project and the NEPA No Action alternatives, including the rationale for developing these two different scenarios for this EIR/EIS, are explained in Chapter 4[15].

Although implementation of the RD-1644 Long-term instream flow requirements would occur under both the CEQA No Project and the NEPA No Action alternatives, the resultant model outputs for both scenarios are different because of variations in the way near-term and long-term future operations are characterized for other parameters in the CEQA and NEPA assumptions. As discussed in Chapter 4, the principal difference between the CEQA No Project Alternative and the NEPA No Action Alternative is that the NEPA No Action Alternative includes several potential future water projects in the Sacramento Valley (e.g., CVP/SWP Intertie, FRWP, SDIP and a long-term EWA Program or a program equivalent to the EWA), while the CEQA No Project Alternative does not. Because many of the other assumed conditions for these two scenarios are similar, the longer-term analysis of the NEPA No Action Alternative compared to the NEPA Affected Environment builds upon the nearer-term analysis of the CEQA No Project Alternative compared to the CEQA Existing Condition.

Because the same foundational modeling base (OCAP Study 3) was used to characterize near-term conditions (2001 level of development) both the CEQA No Project Alternative and the CEQA Existing Condition, it was possible to conduct a detailed analysis to quantitatively evaluate the hydrologic changes in the Yuba Region and the CVP/SWP system that would be expected to occur under these conditions. Building on this CEQA analysis, the analysis of the NEPA No Action Alternative compared to the NEPA Affected Environment consists of two components: (1) an analysis of near-term future without project conditions quantified through the CEQA No Project Alternative, relative to the CEQA Existing Condition; and (2) a qualitative analysis of longer-term future without project conditions (the NEPA No Action Alternative)[16].

10.2.7.1 CEQA No Project Alternative Compared to the CEQA Existing Condition

Yuba Region

New Bullards Bar Reservoir

Impact 10.2.7-1: Decreases in New Bullards Bar Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June, with the majority of warmwater fish spawning occurring during the months of April and May. Decreases in the water surface elevation of New Bullards Bar Reservoir by more than 6 feet per month would occur the same number of times during March and April, six (out of 72) times more often during May, and seven (out of 72) times more often during June under the CEQA No Project Alternative relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 75 through 86). These reductions in water surface elevations would not be anticipated to

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[15] For modeling purposes related to CEQA analytical requirements, OCAP Study 3 (2001 level of development) is used as the foundational study upon which the modeling scenarios for the CEQA No Project Alternative and the CEQA Existing Condition were developed. For modeling purposes related to NEPA analytical requirements, OCAP Study 5 (2020 level of development) is used as the foundational study upon which the modeling scenarios for the NEPA No Action Alternative was developed.

[16] The second analytical component cannot be evaluated quantitatively due to the differences in the underlying baseline assumptions for OCAP Study 3 and OCAP Study 5.

result in substantial reductions in warmwater fish spawning success because these potential decreases in water surface elevation would not be expected to occur during more than two months of any spawning season. In addition, a 60 percent nest success rate or greater is achieved during some months of any annual spawning season, which is expected to provide sufficient recruitment of individuals into the population over the 72-year simulation period. Therefore, changes in water surface elevations that could occur under the CEQA No Project Alternative would result in a less than significant impact on New Bullards Bar Reservoir warmwater fisheries, relative to the CEQA Existing Condition.

Impact 10.2.7-2: Decreases in New Bullards Bar Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

The CEQA No Project Alternative results in long-term average New Bullards Bar Reservoir storage of approximately 821 TAF in April to 600 TAF in November (Appendix f4, 2 vs. 1, pg. 1). This reduction corresponds to a change in water surface elevation from approximately 1,923 feet msl to 1,865 feet msl. Under the CEQA Existing Condition, the November long-term average storage in New Bullards Bar Reservoir is approximately 567 TAF with a corresponding elevation of 1,857 feet msl (Appendix F4, 2 vs. 1, pg. 50).

Anticipated changes in reservoir storage associated with the CEQA No Project Alternative would not be expected to substantively affect the New Bullards Bar Reservoir's coldwater fisheries because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample coldwater pool reserves. Therefore, changes in end-of-month storage that could occur under the CEQA No Project Alternative would result in a less than significant impact on New Bullards Bar Reservoir coldwater fisheries, relative to the CEQA Existing Condition.

Lower Yuba River

The following sections describe and discuss flow and water temperature differences between the CEQA No Project Alternative and the CEQA Existing Condition, and potential effects on fisheries and aquatic resources in the lower Yuba River.

Impact 10.2.7-3: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The adult immigration and holding life stage primarily extends from March through October. Evaluation of flows at Marysville occurring under the CEQA No Project Alternative and the CEQA Existing Condition indicate that both alternatives provided adequate flows for adult spring-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam (Appendix F4, 2 vs. 1, pg. 272). Also, under the CEQA No Project Alternative and the CEQA Existing Condition, flows in the lower Yuba River throughout the upstream migration period generally remain within the range sufficient to allow adequate passage of adult spring-run Chinook salmon through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville result in the same number of occurrences (4 out of 576 months included in the analysis) during which flows at the Daguerre Point Dam fish ladders exceed 10,000 cfs under both the CEQA No Project Alternative and the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 273 through 284). Finally, overall examination of monthly mean stage simulated at Smartville results in 19 decreases of one foot or more (out of 576 months included in the analysis) under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 162 through 173). These relatively infrequent and minor changes in stage would not affect adult spring-run Chinook salmon holding habitat conditions, particularly due to the deep nature of the pools in the Narrows Reach below Englebright Dam.

During the March through October adult immigration and holding life stage, water temperatures at Smartville, under both the CEQA No Project Alternative and the CEQA Existing Condition, generally remain at or below 57°F, which is below the lowest water temperature index value (60°F), and therefore remain suitable, for this life stage (Appendix F4, 2 vs. 1, pg. 174).

Simulated water temperatures at Daguerre Point Dam under both the CEQA No Project Alternative and the CEQA Existing Condition generally do not exceed 60°F over the entire cumulative water temperature distributions from March through August, and during October. During September under the CEQA No Project Alternative, water temperatures remain below 60°F with about a 60 percent probability, and about a 70 percent probability under the CEQA Existing Condition. Measurable water temperature reductions, and therefore more suitable conditions, generally would occur during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures equal or exceed 60°F under the CEQA Existing Condition. Overall, during the entire March through October adult immigration and holding period at Daguerre Point Dam, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 6 decreases below the 60°F index value, 1 increase above the 64°F index value, and no changes at the 68°F index value (Appendix G, 2 vs. 1, pgs. G-202 through G-204).

In addition, while the presence of spring-run Chinook salmon below Daguerre Point Dam during the immigration and holding life stage is believed to be transitory, the cumulative water temperature distributions under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would be essentially equivalent and generally cool (< 55°F), and therefore suitable, at Marysville during March and April. During May at Marysville, water temperatures under the CEQA No Project Alternative would be substantially and consistently lower (1°F – more than 4°F), and therefore more suitable, under relatively warm water temperature conditions, when temperatures under the CEQA Existing Condition otherwise exceed 60°F. During June at Marysville, water temperatures under the CEQA No Project Alternative would be substantially and consistently lower (1°F – nearly 5°F), and therefore more suitable, under relatively warm water temperature conditions, when temperatures under the CEQA Existing Condition otherwise exceed 62.5°F (Appendix F4, 2 vs. 1, pgs. 371 through 382).

From July through September at Marysville, water temperatures would be measurably and substantially higher, and therefore less suitable for adult immigration and holding, over most of the cumulative water temperature distributions, with the exception of the relatively infrequent and warmest water temperature conditions. During July, water temperatures exceed 60°F with about a 75 percent probability under the CEQA No Project Alternative, but with a 40 percent probability under the CEQA Existing Condition. A similar but more dramatic trend is observed during August, when 60°F is exceed 80 percent of the time under the CEQA No Project Alternative, and only 25 percent of the time under the CEQA Existing Condition. During September, measurable water temperature increases frequently would occur when water temperatures exceed 60°F under the CEQA No Project Alternative. However, under warm water temperature conditions (≥ 65°F) which would occur with about a 25 percent probability, the CEQA No Project Alternative results in consistent and measurable water temperature decreases, and therefore more suitable water temperature conditions. During October, both the CEQA No Project Alternative and the CEQA Existing Condition would be characterized by water temperatures below 60°F with about a 75 percent probability. Overall, during the March through October adult immigration and holding life stage at Marysville, the CEQA No Project Alternative, relative to the CEQA Existing Condition results in 58 increases above the 60°F index value, 9 increases above the 64°F index value, and 11 decreases below the 68°F index value (Appendix F4, 2 vs. 1, pgs. 371 through 382).

Spring-run Chinook salmon spawning reportedly occurs above Daguerre Point Dam from September through November. During these months, the annual spawning habitat availability under the CEQA No Project Alternative would be identical to that under the CEQA Existing Condition (long-term average of 89.1 percent of the maximum WUA) (Appendix F4, 2 vs. 1, pg. 395). The CEQA No Project Alternative would achieve over 90 percent of maximum WUA with a 68 percent probability, while the CEQA Existing Condition would achieve over 90 percent of maximum WUA with a 66 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 2 vs. 1, pg. 399).

The spring-run Chinook salmon spawning habitat analysis also emphasized the month of September, because this is the only month during the spring-run Chinook salmon spawning period that is assumed to not temporally overlap with fall-run Chinook salmon spawning (CDFG 2000). For September, spawning habitat availability, expressed as percent maximum WUA, under the CEQA No Project Alternative is higher than under the CEQA Existing Condition (long-term average of 90.3 percent versus 87.2 percent of maximum WUA) (Appendix F4, 2 vs. 1, pg. 395). Overall, for the month of September, the CEQA No Project Alternative achieves over 90 percent of maximum WUA with about a 62 percent probability, whereas the CEQA Existing Condition achieves over 90 percent of maximum WUA with about a 55 percent probability. Overall, increases of 10 percent or more in spawning habitat availability would occur over about 9.9 percent (7 out of 71 years) of the September cumulative WUA distributions (Appendix F4, 2 vs. 1, pg. 397).

Water temperatures at Smartville during the September through November spawning period generally do not exceed 56°F, and therefore remain suitable for this life stage (Appendix F4, 2 vs. 1, pgs. 175 through 186). Simulated water temperatures at Daguerre Point Dam during November do not exceed 56°F, and therefore remain suitable for adult spawning (Appendix F4, 2 vs. 1, pgs. 224 through 235). During September, simulated water temperatures at Daguerre Point Dam: exceed 56°F over the entire cumulative water temperature distributions; would be essentially equivalent over approximately 50 percent, would be measurably higher over approximately 35 percent, and would be measurably lower over approximately 15 percent of the cumulative water temperature distributions; and would be lower, and therefore more suitable under relatively warm water temperature conditions, when water temperatures equal or exceed 61°F, under both the CEQA No Project Alternative and the CEQA Existing Condition. During October, simulated water temperatures at Daguerre Point Dam under both the CEQA No Project Alternative and the CEQA Existing Condition exceed 56°F with about a 90 percent probability, and would be essentially equivalent over nearly the entire cumulative water distribution (Appendix F4, 2 vs. 1, pgs. 248 through 259). Overall, during the entire September through November spawning period, at Daguerre Point Dam the CEQA No Project Alternative relative to the CEQA Existing Condition results in 1 increase above the 56°F index value, 5 increases above the 58°F index value, 8 increases above the 60°F index value, and 6 decreases below the 62°F index value (Appendix G, 2 vs. 1, pgs. G-202 through G-204).

The embryo incubation life stage for spring-run Chinook salmon in the lower Yuba River generally occurs between September and March. In addition to the water temperature trends described above for the spawning life stage, water temperatures at Daguerre Point Dam from December through March generally do not exceed 53°F, do not approach the lowest water temperature index value (56°F), and therefore remain suitable, under both the CEQA No Project Alternative and the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 248 through 259).

Spring-run Chinook salmon juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to spring-run Chinook salmon juveniles.

Simulated water temperatures at Smartville generally remain below the lowest water temperature index value (60°F), and therefore remain suitable for this life stage year-round, under both the CEQA No Project Alternative and the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 175 through 186). At Daguerre Point Dam, water temperatures generally remain below 60°F, and therefore suitable, during most months, with the exception of September (Appendix F4, 2 vs. 1, pgs. 224 through 235). During September under the CEQA No Project Alternative, water temperatures remain below 60°F with about a 60 percent probability, and about a 70 percent probability under the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 248 through 259). Measurable water temperature reductions, and therefore more suitable conditions, generally would occur during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures equal or exceed 60°F under the CEQA Existing Condition (Appendix G, 2 vs. 1, pgs. G-202 through G-204).

At Marysville, water temperatures generally remain below the lowest water temperature index value (60°F), and therefore remain suitable for this life stage from November through May, under both the CEQA No Project Alternative and the CEQA Existing Condition. During June, water temperatures under the CEQA No Project Alternative would be substantially and consistently lower (1°F – nearly 5°F), and therefore more suitable, under relatively warm (≥ 62.5°F) water temperature conditions. From July through September, water temperatures would be measurably and substantially higher, and therefore less suitable for juvenile rearing, over most of the cumulative water temperature distributions, with the exception of the relatively infrequent and warmest water temperature conditions during July and August. During September, measurable water temperature increases frequently would occur when water temperatures exceed 60°F, although consistent and measurable water temperature decreases, and therefore more suitable water temperature conditions would occur under warm water temperature conditions (≥ 65°F). During October, both the CEQA No Project Alternative and the CEQA Existing Condition would be characterized by water temperatures below 60°F with about a 75 percent probability (Appendix F4, 2 vs. 1, pgs. 347 through 358).

Overall, during the year-round juvenile rearing life stage at Daguerre Point Dam, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 6 decreases below the 60°F index value, 1 increase above the 63°F index value, 2 increases above the 65°F index value, no change at the 68°F, 70°F or 75°F index values. Overall, at Marysville, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 57 increases above the 60°F index value, 25 increases above the 63°F index value, 10 decreases below the 65°F index value, 11 decreases below the 68°F index value, 4 decreases below the 70°F index value, and no change at the 75°F index value (Appendix G, 2 vs. 1, pgs. G-202 through G-204).

The spring-run Chinook salmon smolt emigration period is believed to extend from November through June, although based on CDFG's run-specific determinations, the vast majority (about 94 percent) of spring-run Chinook salmon were captured as post-emergent fry during November and December, with a relatively small percentage (nearly 6 percent) of individuals remaining in the lower Yuba River and captured as YOY from January through March. Only 0.6 percent of the juvenile Chinook salmon identified as spring-run was captured during April, 0.1 percent during May, and none were captured during June. Differences in flows under the CEQA No Project Alternative relative to the CEQA Existing Condition exhibit similar trends at Smartville and at Marysville, from November through June. During November and December, measurable flow increases generally would occur at relatively high flow levels, and would be essentially equivalent or generally higher under low flow conditions, which would not be expected to substantively affect smolt emigration. During January, substantial flow increases would occur at intermediate flow levels, and equivalent or measurably higher flows would occur at low flow levels. During February, relatively minor changes would occur, although equivalent or measurably higher flows would occur under low flow conditions. During March, flows would be generally equivalent, with minor but measurable flow reductions occurring with about a 30 to 50 percent probability, under the CEQA No Project Alternative relative to the CEQA Existing Condition. April, May and June would be typically characterized by relatively large (20 to over 100 percent) increases in flow under relatively low flow conditions (Appendix F4, 2 vs. 1, pgs. 125 through 136 and 297 through 308).

During the November through June smolt emigration life stage, water temperatures at Smartville under both the CEQA No Project Alternative and the CEQA Existing Condition generally remain below 60°F, and therefore remain suitable for this life stage (Appendix F4, 2 vs. 1, pgs. 175 through 186 and 199 through 210). At Daguerre Point Dam, water temperatures generally remain below 60°F from November through May. During June under the CEQA No Project Alternative, water temperatures remain below 60°F with about a 98 percent probability, by contrast to about an 80 percent probability under the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 248 through 259). At Marysville, water temperatures generally remain below the lowest water temperature index value (60°F), and therefore remain suitable for this life stage from November through April, under both the CEQA No Project Alternative and the CEQA Existing Condition. During May and June at Marysville, water temperatures under the CEQA No Project Alternative would be substantially and consistently lower (1°F – nearly 5°F), and therefore more suitable, under relatively warm water temperature conditions, when temperatures under the CEQA Existing Condition otherwise exceed 60°F (Appendix F4, 2 vs. 1, pgs. 371 through 382).

Overall, during the entire November through June smolt emigration period at Daguerre Point Dam, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 10 decreases below the 60°F index value, and no changes at other index values. Overall at Marysville, the CEQA No Project Alternative relative to the CEQA Existing Condition, results in 10 decreases below the 60°F index value, 11 decreases below the 63°F index value, 1 decrease below the 68°F index value, and no changes at the 70°F index value (Appendix G, 2 vs. 1, pgs. G-202 through G-204).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative is expected to provide:

- Generally equivalent or improved adult immigration and holding conditions due to: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) relatively minor and infrequent changes in holding habitat conditions above Daguerre Point Dam; (4) generally equivalent and suitable water temperatures above Daguerre Point Dam; and (5) during May and June at Marysville, substantially and consistently lower (1°F – nearly 5°F), and therefore more suitable, water temperatures under relatively warm water temperature conditions, when temperatures otherwise exceed 60°F

- Improved spawning conditions due to: (1) identical spawning habitat availability during the entire September through November adult spawning period; (2) higher spawning habitat availability, with increases of 10 percent or more in spawning habitat availability nearly ten percent of the time during September separately as a temporally distinct month; and (3) generally lower, and therefore more suitable water temperatures during September under about 20 percent of the warmest water temperature conditions, which represent otherwise stressful conditions for this life stage

- Improved embryo incubation conditions due to: generally lower, and therefore more suitable water temperatures during September under about 20 percent of the warmest water temperature conditions, which represent otherwise stressful conditions for this life stage; generally equivalent water temperatures during October; and suitable embryo incubation temperatures from November through March

- Generally equivalent or less suitable over-summer juvenile rearing conditions due to: (1) generally suitable water temperature conditions above Daguerre Point Dam; (2) substantially and consistently lower (1°F – nearly 5°F), and therefore more suitable, water temperatures under relatively warm (≥ 62.5°F) water temperature conditions at Marysville during June; (3) measurably and substantially higher, and therefore less suitable, water temperatures over most of the cumulative water temperature distributions, with the exception of relatively infrequent and warmest (about 5 percent) water temperature conditions during July and August at Marysville; and (4) measurably higher water temperatures about 70 percent of the time during September, but measurably lower water temperatures under relatively warm water temperature conditions, when water temperatures equal or exceed 65°F at Marysville

- Generally equivalent or improved smolt emigration conditions due to: (1) measurable flow increases at intermediate to relatively high flow levels, and essentially equivalent or generally higher flows under about the lowest 20 percent of flow conditions from November through February; (2) generally equivalent flows, with minor but measurable flow reductions, yet flows remaining above 700 cfs at Smartville and 750 cfs at Marysville during March with about a 95 percent probability; (3) relatively large (20 to over 100 percent) increases in flow under relatively low flow conditions (i.e., lowest 25 percent of simulated flow conditions) during April, May and June; (4) generally suitable water temperatures above Daguerre Point Dam; and (5) substantially and consistently lower (1°F – nearly 5°F), and therefore more suitable, water temperatures under relatively warm water temperature conditions (≥ 60°F) during May and June at Marysville

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon, the CEQA No Project Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Yuba River spring-run Chinook salmon.

Impact 10.2.7-4: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The adult immigration and holding life stage for fall-run Chinook salmon in the lower Yuba River primarily extends from August through November. Evaluation of flows at Marysville occurring under the CEQA No Project Alternative and the CEQA Existing Condition indicate that both alternatives provided adequate flows for adult fall-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam. Also, under the CEQA No Project Alternative and the CEQA Existing Condition, flows in the lower Yuba River throughout the upstream migration period remain within the range sufficient to allow adequate passage of adult fall-run Chinook salmon through the Daguerre Point Dam fish ladders (Appendix F4, 2 vs. 1, pgs. 297 through 308).

During August and September at Smartville, flows exhibit the trend of measurable flow increases under relatively low flow conditions, but consistent and substantial decreases at intermediate to high flow levels. During October at Smartville, measurable flow decreases consistently would occur from intermediate to high flow levels, and measurable flow increases consistently would occur from low to intermediate flow levels. At Marysville during August and September, substantial flow reductions would occur at all but the lowest flow levels. During October at Marysville, measurable flow decreases consistently would occur at all but the lowest flow levels, at which they remain generally equivalent. During November at both locations, measurable flow increases generally would occur at relatively high flow levels, and would be essentially equivalent or generally higher under low flow conditions (Appendix F4, 2 vs. 1, pgs. 125 through 136 and 297 through 308).

During the August through November adult immigration and holding life stage, water temperatures at Smartville, under both the CEQA No Project Alternative and the CEQA Existing Condition, generally remain below 57°F, which is below the lowest water temperature index value (60°F), and therefore remain suitable, for this life stage (Appendix F4, 2 vs. 1, pgs. 175 through 186).

Simulated water temperatures at Daguerre Point Dam under both the CEQA No Project Alternative and the CEQA Existing Condition generally do not exceed 60°F over the entire cumulative water temperature distributions during August, October and November. During September under the CEQA No Project Alternative, water temperatures remain below 60°F with about a 60 percent probability, and about a 70 percent probability under the CEQA Existing Condition. Measurable water temperature reductions, and therefore more suitable conditions, generally would occur during September at Daguerre Point Dam under relatively warm water temperature conditions, when water temperatures equal or exceed 60°F under the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 248 through 259).

During August and September at Marysville, water temperatures would be measurably and substantially higher, and therefore less suitable for adult immigration and holding, over most of the cumulative water temperature distributions, with the exception of the relatively infrequent and warmest water temperature conditions. During August, water temperatures exceed 60°F with about an 80 percent probability under the CEQA No Project Alternative, but with a 25 percent probability under the CEQA Existing Condition. During September, measurable water temperature increases frequently would occur when water temperatures exceed 60°F under the CEQA No Project Alternative. However, under warm water temperature conditions (≥ 65°F) which would occur with about a 25 percent probability, the CEQA No Project Alternative results in consistent and measurable water temperature decreases, and therefore more suitable water temperature conditions. During October, both the CEQA No Project Alternative and the CEQA Existing Condition would be characterized by water temperatures below 60°F with about a 75 percent probability. At Marysville, water temperatures generally remain below the lowest water temperature index value (60°F), and therefore remain suitable for this life stage during November, under both the CEQA No Project Alternative and the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 371 through 382).

Overall, during the entire August through November adult immigration and holding period at Daguerre Point Dam, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 6 increases above the 60°F index value, 1 increase above the 64°F index value, and no change at the 68°F index value (Appendix F4, 2 vs. 1, pgs. 224 through 235). Overall at Marysville, the CEQA No Project Alternative relative to the CEQA Existing Condition, results in 44 increases above the 60°F index value, 13 increases above the 64°F index value, and 7 decreases below the 68°F index value (Appendix F4, 2 vs. 1, pgs. 347 through 358).

Fall-run Chinook salmon spawning occurs in the lower Yuba River from October through December, and may extend into January. During these months, the annual spawning habitat availability under the CEQA No Project Alternative would be slightly lower than under the CEQA Existing Condition (long-term average of 86.8 percent versus 88.6 percent of the maximum WUA) (Appendix F4, 2 vs. 1, pg. 400). The CEQA No Project Alternative would achieve over 90 percent of maximum WUA with a 63 percent probability, while the CEQA Existing Condition would achieve over 90 percent of maximum WUA with a 70 percent probability. Overall, changes of 10 percent or more in spawning habitat availability would not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 2 vs. 1, pg. 402).

During the October through December adult spawning life stage, water temperatures at Smartville, under both the CEQA No Project Alternative and the CEQA Existing Condition, generally remain at or below 56°F, and therefore remain suitable for this life stage (Appendix F4, 2 vs. 1, pgs. 199 through 210). Simulated water temperatures at Daguerre Point Dam during November and December also do not exceed 56°F. During October at Daguerre Point Dam, water temperatures would be essentially equivalent over nearly the entire cumulative water temperature distribution. Water temperatures under both alternatives exceed 56°F nearly 90 percent of the time, yet generally remain below 58°F (Appendix F4, 2 vs. 1, pgs. 248 through 259). During October at Marysville, water temperatures would be essentially equivalent about 50 percent of the time, with measurable water temperature increases occurring nearly 50 percent of the time. The measurable water temperature increases generally would occur at low to intermediate water temperature conditions, when water temperatures range from about 57 - 59°F. At Marysville, water temperatures generally remain below the lowest water temperature index value (56°F), and therefore remain suitable for this life stage during November and December under both the CEQA No Project Alternative and the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 371 through 382).

Overall, the CEQA No Project Alternative results in 1 increase above the 56°F index value, no change at the 58°F index value, 1 increase above the 60°F index value, and 1 increase above the 62°F index value at Daguerre Point Dam; and no changes at the 56°F index value, 6 increases above the 58°F index value, 1 increase above the 60°F index value, and 1 increase above the 62°F index value at Marysville (Appendix F4, 2 vs. 1, pgs. 224 through 235 and 347 through 358).

The embryo incubation period for fall-run Chinook salmon extends from October through March. In addition to the trends described above, from January through March, water temperatures do not exceed 54°F, do not approach the lowest water temperature index value (56°F), and therefore remain suitable, at Smartville, Daguerre Point Dam and Marysville under the CEQA No Project Alternative and the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 199 through 210, 248 through 259, and 371 through 382). Overall, during the embryo incubation life stage, the CEQA No Project Alternative results in 1 increase above the 56°F index value, no change at the 58°F index value, 1 increase above the 60°F index value, and 1 increase above the 62°F index value at Daguerre Point Dam, relative to CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 224 through 235).

Juvenile fall-run Chinook salmon rear in and emigrate from the lower Yuba River between December and June, although based on CDFG's run-specific determinations, the majority (about 81 percent) of fall-run Chinook salmon would be captured moving downstream from December through March, with decreasing numbers captured during April (about 9 percent), May (about 7 percent), and June (about 3 percent). The discussion of flow and water temperature changes provided for spring-run Chinook salmon smolt emigration (see above) encompasses the entire fall-run Chinook salmon juvenile rearing and outmigration time period. The only differences are that the juvenile fall-run Chinook salmon rearing and outmigration period encompasses one less month (November), and includes slightly different water temperature index values. Overall, during the entire December through June juvenile rearing and outmigration period at Daguerre Point Dam, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 10 decreases below the 60°F index value, and no changes at other values. Overall at Marysville, the CEQA No Project Alternative relative to the CEQA Existing Condition, results in 10 decreases below the 60°F index value, 11 decreases below the 63°F index value, 16 decreases below the 65°F index value, 1 decrease below the 68°F, and no change at the 70°F index value (Appendix G, 2 vs. 1, pgs. G-206 through G-207).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative is expected to provide:

- Generally equivalent adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) generally equivalent and suitable water temperatures above Daguerre Point Dam; and (4) during August and September at Marysville, measurably and substantially higher, and therefore less suitable, water temperatures over most of the cumulative water temperature distributions (90 and 70 percent, respectively), with water temperature decreases during 5 and 25 percent of the warmest (≥ 65°F) water temperature conditions during August and September, respectively

- Generally equivalent or less suitable spawning conditions due to: slightly lower spawning habitat availability during the adult spawning period; generally equivalent and suitable water temperatures throughout this life stage at Smartville and at Daguerre Point Dam, and at Marysville during November and December; and measurable water temperature increases about 45 percent of the time under low to intermediate water temperature conditions at Marysville during October, when water temperatures range from about 57 - 59°F

- Generally equivalent or less suitable embryo incubation conditions due to similar water temperatures at Smartville and at Daguerre Point Dam throughout this life stage, and measurable water temperature increases at low to intermediate water temperature conditions (57 - 59°F) at Marysville during October
- Generally equivalent or improved juvenile rearing and outmigration conditions due to: (1) measurable flow increases at intermediate to relatively high flow levels, and essentially equivalent or generally higher flows under about the lowest 20 percent of flow conditions from December through February; (2) generally equivalent flows, with minor but measurable flow reductions, yet flows remaining above 700 cfs at Smartville and 750 cfs at Marysville during March with about a 95 percent probability; (3) relatively large (20 to over 100 percent) increases in flow under relatively low flow conditions (i.e., lowest 25 percent of simulated flow conditions) during April, May and June; (4) generally suitable water temperatures above Daguerre Point Dam; and (5) substantially and consistently lower (1°F – nearly 5°F), and therefore more suitable, water temperatures under relatively warm water temperature conditions (≥ 60°F) during May and June at Marysville

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon, the CEQA No Project Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Yuba River fall-run Chinook salmon.

Impact 10.2.7-5: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the lower Yuba River extends from August through March. Evaluation of flows at Marysville occurring under the CEQA No Project Alternative and the CEQA Existing Condition indicate that both alternatives provide adequate flows for adult steelhead upstream critical riffle passage below Daguerre Point Dam. Also, under the CEQA No Project Alternative and the CEQA Existing Condition, flows in the lower Yuba River throughout the upstream migration period generally remain within the range sufficient to allow adequate passage of adult steelhead through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville result in 1 additional occurrence during which flows at the Daguerre Point Dam fish ladders exceed 10,000 cfs under the CEQA No Project Alternative (14 out of 576 months included in the analysis), relative to the CEQA Existing Condition (13 out of 576 months) (Appendix F4, 2 vs. 1, pgs. 273 through 284).

From August through October of the adult immigration and holding life stage at Smartville, in general, flows exhibit the trend of measurable flow increases under relatively low flow conditions, but consistent and substantial decreases at intermediate to high flow levels (Appendix F4, 2 vs. 1, pgs. 125 through 136). At Marysville from August through October, substantial flow reductions would occur at all but the lowest flow levels, at which they remain generally equivalent or increase (Appendix F4, 2 vs. 1, pgs. 297 through 308).

During November at both locations, measurable flow increases generally would occur at relatively high flow levels, and would be essentially equivalent or generally higher under low flow conditions. Differences in flows under the CEQA No Project Alternative relative to the CEQA Existing Condition exhibit similar trends at Smartville and at Marysville, from December through March. In general, from December through February measurable flow increases generally would occur under relatively low flow conditions. During March, flows would be generally equivalent, with minor but measurable flow reductions occurring throughout the cumulative flow distributions.

During the adult immigration and holding life stage, water temperatures at Smartville during August, September, and October always exceed 52°F, yet generally remain below 56°F under both the CEQA No Project Alternative and the CEQA Existing Condition. From November through March, water temperatures consistently remain below 52°F under both alternatives at Smartville (Appendix F4, 2 vs. 1, pgs. 199 through 210). At Daguerre Point Dam during August and September, under the CEQA No Project Alternative water temperature increases would occur at intermediate to low water temperature conditions, by contrast to water temperature decreases at warm water temperature conditions - water temperatures typically exceed 56°F under both alternatives. Water temperatures would be equivalent over nearly the entire cumulative water temperature distribution in October; and generally remain below 52°F, and therefore remain suitable, from November through March under both alternatives (Appendix F4, 2 vs. 1, pgs. 248 through 259).

At Marysville, water temperatures generally exceed the water temperature index values of 52°F and 56°F from August through October under both the CEQA No Project Alternative and the CEQA Existing Condition. Measurable water temperature increases consistently would occur at nearly all but the warmest water temperature conditions during August, at low to intermediate water temperature conditions during September, and under relatively low to intermediate conditions during October under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Measurable water temperature decreases would occur at the relatively infrequent and warmest water temperature conditions during August, and during the warmest (25 percent) conditions during September. During November, water temperatures under the CEQA No Project Alternative remain below the 52°F index value, and therefore remain suitable for this life stage approximately 60 percent of the time, whereas under the CEQA Existing Condition water temperatures remain below 52°F approximately 25 percent of the time. However, under the warmest 10 percent of water temperature conditions at Marysville, measurable water temperature increases would occur under the CEQA No Project Alternative, yet water temperatures remain below 56°F. From December through February at Marysville, water temperatures remain below the lowest water temperature index value (52°F), and therefore remain suitable for adult immigration and holding, under both the CEQA No Project Alternative and the CEQA Existing Condition. During March, water temperatures would be generally equivalent and remain below 52°F more than 50 percent of the time, and always remain below 54°F (Appendix F4, 2 vs. 1, pgs. 371 through 382).

Overall, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 1 increase above the 52°F index value, 3 increases above the 56°F index value, and no changes at the 70°F index value at Smartville (Appendix F4, 2 vs. 1, pgs. 175 through 186). Overall, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 3 increases above the 52°F index value, 16 increases above the 56°F index value, and no changes at the 70°F index value at Daguerre Point Dam (Appendix F4, 2 vs. 1, pgs. 224 through 235). Overall, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 21 decreases below the 52°F index value, and 2 increases above the 56°F index value, and 2 decreases below the 70°F index value at Marysville (Appendix F4, 2 vs. 1, pgs. 347 through 358).

The steelhead spawning season generally extends from January through April, primarily occurring in reaches upstream of Daguerre Point Dam. During these months, the annual spawning habitat availability under the CEQA No Project Alternative is slightly lower than that under the CEQA Existing Condition (long-term average of 35.6 percent versus 38.5 percent of the maximum WUA) (Appendix F4, 2 vs. 1, pg. 403). The CEQA No Project Alternative achieves over 50 percent of maximum WUA with about a 30 percent probability, whereas the CEQA Existing Condition achieves over 50 percent of maximum WUA with about a 35 percent probability. Overall, decreases of 10 percent or more in spawning habitat availability would occur over about 12.5 percent (9 out of 72 years) of the cumulative WUA distributions (Appendix F4, 2 vs. 1, pg. 405).

From January through April at Smartville and from January through March at Daguerre Point Dam, water temperatures generally remain below 52°F, which is the lowest water temperature index value for this life stage, and therefore remain suitable for adult spawning (Appendix F4, 2 vs. 1, pgs. 199 through 210 and 248 through 259). During April at Daguerre Point Dam, water temperatures would be essentially equivalent over about 80 percent of the cumulative water temperature distributions, and would be consistently and measurably lower, and therefore more suitable under relatively warm (≥ 54.5°F) water temperature conditions under the CEQA No Project Alternative. Overall, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 1 decrease below the 54°F index value, and no changes at other index values at Daguerre Point Dam (Appendix F4, 2 vs. 1, pgs. 224 through 235).

The embryo incubation period for steelhead in the lower Yuba River general overlaps with the spawning period, but extends into May. Under the CEQA No Project Alternative during May, water temperatures at Smartville would be consistently lower, and therefore more suitable, under relatively warm (≥ 52°F) water temperature conditions, but water temperatures remain below 54°F (Appendix F4, 2 vs. 1, pgs. 175 through 186). At Daguerre Point Dam during May, water temperatures would be consistently lower, and therefore more suitable, under relatively warm (> 55°F) water temperature conditions, but water temperatures remain below 58°F (Appendix F4, 2 vs. 1, pgs. 224 through 235). Overall, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 5 decreases below the 52°F index value, and no changes at other index values at Smartville. Overall, the CEQA No Project Alternative relative to the CEQA Existing Condition results in no change at the 52°F index value, 1 decrease below the 54°F index value, 13 decreases below the 57°F index value, and no change at the 60°F index value at Daguerre Point Dam (Appendix F4, 2 vs. 1, pgs. 347 through 358).

Steelhead juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles.

The discussion of general water temperature changes provided for spring-run Chinook salmon year-round juvenile rearing (see above) applies to the steelhead juvenile rearing life stage. The only difference is that the steelhead juvenile rearing life stage includes slightly different water temperature index values. Water temperatures generally remain below 65°F, and therefore remain suitable for steelhead juvenile rearing, throughout the year at Smartville and Daguerre Point Dam. At Marysville, water temperatures remain below 65°F for all months of the year with the exceptions of July, August and September. At Marysville during July and August, water temperatures exceed 65°F about 20 percent of the time under the CEQA No Project Alternative, and about 10 percent of the time under the CEQA Existing Condition. However, water temperatures under the CEQA No Project Alternative would be measurably and substantially (about 0.5 – 4°F) cooler, and therefore more suitable, during July when water temperatures would be warmest (from about 67 - 74°F under the CEQA Existing Condition). A similar trend is observed at Marysville during August. During September at Marysville, water temperatures exceed 65°F about 25 percent of the time under both the CEQA No Project Alternative and the CEQA Existing Condition. However, measurable water temperature decreases consistently would occur, and therefore would be more suitable, during September at Marysville when water temperatures exceed 65°F under the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 371 through 382). Overall, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 2 increases above the 65°F index value, and no change at the 68°F, 72°F or 75°F index values at Daguerre Point Dam (Appendix F4, 2 vs. 1, pgs. 224 through 235). Overall, at Marysville, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 10 decreases below the 65°F index value, 11 decreases below the 68°F index value, no changes at the 72°F or 75°F index values (Appendix F4, 2 vs. 1, pgs. 347 through 358).

The steelhead smolt emigration period is believed to extend from October through May. The discussion of flow and water temperature changes provided for spring-run Chinook salmon smolt emigration (see above) encompasses nearly the entire fall-run Chinook salmon juvenile rearing and outmigration time period. The only differences are that the steelhead smolt emigration period encompasses one additional month (October) and one less month (June), and includes different water temperature index values. During October at Smartville, measurable flow decreases consistently would occur from intermediate to high flow levels, and measurable flow increases consistently would occur from low to intermediate flow levels. During October at Marysville, measurable flow decreases consistently would occur at all but the lowest flow levels, at which they remain generally equivalent (Appendix F4, 2 vs. 1, pgs. 125 through 136 and 297 through 308).

During the steelhead smolt emigration life stage, water temperatures at Smartville during October always exceed 52°F, yet generally remain below 56°F under both the CEQA No Project Alternative and the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 199 through 210). Water temperatures at Daguerre Point Dam would be equivalent over nearly the entire cumulative water temperature distributions in October under both alternatives, and generally remain below 58°F (Appendix F4, 2 vs. 1, pgs. 248 through 259). At Marysville, water temperatures generally exceed the water temperature index value of 56°F, with measurable water temperature increases frequently occurring under relatively cool water temperature conditions (about 57 – 59°F) during October under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 371 through 382).

Overall, during the entire October through May smolt emigration period at Smartville, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 4 decreases below the 52°F index value, 1 increase above the 55°F index value, and no changes at the 59°F index value (Appendix F4, 2 vs. 1, pgs. 199 through 210). Overall, during the entire October through May smolt emigration period at Daguerre Point Dam, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 3 increases above the 52°F index value, 14 decreases below the 55°F index value, and 2 increases above the 59°F index value (Appendix F4, 2 vs. 1, pgs. 248 through 259). Overall, the CEQA No Project Alternative relative to the CEQA Existing Condition, results in 21 decreases below the 52°F index value, 1 increase above the 55°F index value, and 4 decreases below the 59°F index value at Marysville (Appendix F4, 2 vs. 1, pgs. 371 through 382).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative is expected to provide:

- Generally equivalent or less suitable adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) generally equivalent and suitable water temperatures from November through March; (4) water temperature increases during August and September at intermediate to low water temperature conditions, by contrast to water temperature decreases at warm water temperature conditions (about 59°F to nearly 62°F), when water temperatures are most stressful, at Daguerre Point Dam; and (5) measurable and consistent water temperature increases at nearly all (about 56°F to nearly 66°F) but the warmest water temperature conditions during August, at low to intermediate water temperature conditions (about 59 – 64.5°F) during September, and under relatively low to intermediate water temperature conditions (about 57 – 59°F) during October at Marysville

- Generally equivalent or less suitable spawning conditions due to lower spawning habitat availability; decreases of 10 percent or more in spawning habitat availability with a 12.5 percent probability; generally equivalent and suitable water temperatures at Smartville, and January through March at Daguerre Point Dam; and consistently measurably lower water temperatures under relatively warm (≥ 54.5°F) water temperature conditions during April at Daguerre Point Dam

- Generally equivalent or improved embryo incubation conditions due to similar water temperature conditions during January through April, with measurably lower water temperatures under 35 percent of the warmest water temperature conditions during May at Smartville; and measurably lower water temperatures under about 25 percent of the warmest water temperature conditions during April and May at Daguerre Point Dam

- Generally equivalent or improved juvenile rearing conditions due to: (1) generally suitable water temperature conditions throughout the year above Daguerre Point Dam; (2) suitable water temperatures at Marysville throughout the year, with the exceptions of July, August and September; (3) measurably higher, and therefore less suitable, water temperatures during July and August at Marysville about 10 percent more often when water temperatures equal or exceed 65°F, although measurable and substantial (about 0.5 – 4°F) lower, and therefore more suitable, water temperatures when water temperatures would be warmest (i.e., warmest 5 percent of all simulated water temperature conditions) and potentially most stressful; and (4) consistent, measurably lower, and therefore would be more suitable, water temperatures during September at Marysville when water temperatures exceed 65°F

- Generally equivalent or improved smolt emigration conditions due to: (1) measurable flow decreases at intermediate to high flow levels, and measurable flow increases at low flow levels during October; (2) measurable flow increases at intermediate to relatively high flow levels, and essentially equivalent or generally higher flows under the lowest 20 percent of flow conditions from November through February; (3) generally equivalent flows throughout the cumulative flow distributions, with minor but measurable flow reductions during low flow conditions (i.e., lowest 25 percent of simulated flow conditions) during March; (4) relatively large (20 to over 100 percent) increases in flow under relatively low flow conditions (i.e., lowest 25 percent of simulated flow conditions) during April and May; (5) generally suitable water temperatures above Daguerre Point Dam; (6) measurably higher water temperatures under relatively cool water temperature conditions (about 57 – 59°F) during October at Marysville; and (7) substantially and consistently lower (1°F – nearly 5°F), and therefore more suitable, water temperatures under relatively warm water temperature conditions (≥ 60°F) during May at Marysville

In conclusion, in consideration of potential impacts to all life stages of steelhead, the CEQA No Project Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Yuba River steelhead.

Impact 10.2.7-6: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect green sturgeon

Flows during the green sturgeon immigration and holding (February through July) and adult spawning and embryo incubation (March through July) life stage periods would be expected to allow adequate upstream migration and spawning habitat availability, under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Overall, under the CEQA No Project Alternative relative to the CEQA Existing Condition, results in 20 increases above the 61°F index value for adult immigration and holding, 4 decreases below the 68°F index value for adult spawning, and 4 decreases below the 68°F index value for embryo incubation (Appendix F4, 2 vs. 1, pgs. 347 through 358).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juveniles.

At Marysville, water temperatures generally remain below 66°F for all months of the year with the exceptions of June, July, August and September. During June, water temperatures remain below 66°F under the CEQA No Project Alternative, but exceed 66°F about 15 percent of the time under the CEQA Existing Condition. During July, water temperatures exceed 66°F about 15 percent of the time under the CEQA No Project Alternative, but about 10 percent of the time under the CEQA Existing Condition, with generally equal occurrences of water temperature increases and decreases under the CEQA No Project Alternative, relative to the CEQA Existing Condition, when water temperatures exceed 66°F. During August, water temperatures exceed 66°F about 5 percent of the time under both alternatives, although the CEQA No Project Alternative results in substantially lower (2 – 4°F), and therefore more suitable water temperatures when water temperatures exceed 66°F. During September at Marysville, water temperatures exceed 66°F about 10 percent of the time under the CEQA No Project Alternative, and about 25 percent of the time under the CEQA Existing Condition, although the CEQA No Project Alternative results in substantially lower (0.5 – 3°F), and therefore more suitable water temperatures, when water temperatures exceed 66°F. Overall, during the year-round green sturgeon juvenile rearing life stage, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 17 decreases below the 66°F index value (Appendix F4, 2 vs. 1, pgs. 347 through 358 and 371 through 382).

The juvenile emigration life stage generally extends from May through September. Trends in flows during this life stage are encompassed in the description above for spring-run Chinook salmon adult immigration and holding. Also, similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juvenile emigration. As described in the discussion of the year-round juvenile rearing period, during the warmest months of June, July, August and September water temperatures under the CEQA No Project Alternative would be generally more suitable than water temperatures under the CEQA Existing Condition. Overall, the CEQA No Project Alternative results in 17 decreases below the 66°F index value during the juvenile emigration life stage (Appendix F4, 2 vs. 1, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative is expected to provide:

- Generally equivalent adult immigration and holding, adult spawning and embryo incubation conditions, because of corresponding upstream migration and spawning flow-related habitat availabilities, and similarly suitable water temperatures
- Generally equivalent or improved over-summer rearing and juvenile emigration conditions, due to generally improved water temperature conditions

In conclusion, in consideration of potential impacts to all life stages of green sturgeon, the CEQA No Project Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Yuba River green sturgeon.

Impact 10.2.7-7: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect American shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Yuba River. Studies conducted on the lower Yuba River suggest that shifting of proportional flows (lower Yuba River flows/lower Feather River flows) may simply re-allocate shad from the Feather River to the lower Yuba River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for American shad attraction into the lower Yuba River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 0.1 percent higher during April, 1.3 percent higher during May, and 0.3 percent lower during June under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Under the CEQA No Project Alternative, during wet years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 0.4 percent lower during April, 0.5 percent lower during May, and 0.8 percent lower during June. During above normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 0.6 percent lower during April, 0.8 percent lower during May, and 1.5 percent lower during June. During below normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 1.0

percent higher during April, 0.1 percent lower during May, and 1.1 percent lower during June. During dry years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 0.5 percent higher during April, 8.3 percent higher during May, and 1.8 percent higher during June. During critical years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 3.7 percent higher during April, 21.1 percent higher during May, and 8.4 percent higher during June (Appendix F4, 2 vs. 1, pgs. 346 and 726).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Changes in long-term average proportionate flows and average proportionate flows by water year type would not be of sufficient magnitude to substantively affect American shad attraction into the lower Yuba River.

Differences in water temperature between the Feather and lower Yuba rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage the CEQA No Project Alternative, relative to the CEQA Existing Condition results in 10 fewer occurrences (out of 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 2 vs. 1, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative would result in a less than significant impact to lower Yuba River American shad.

Impact 10.2.7-8: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Yuba River. Striped bass spawning and initial rearing in the lower Yuba River extends from April through June. Proportionate flow changes resulting from implementation of the CEQA No Project Alternative relative to the CEQA Existing Condition during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Yuba River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Changes in long-term average proportionate flows and average proportionate flows by water year type would not be of sufficient magnitude to substantively affect striped bass attraction into and initial rearing in the lower Yuba River.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 10 fewer occurrences (out of 213 months included in the analysis) when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 2 vs. 1, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative would result in a less than significant impact to lower Yuba River striped bass.

CVP/SWP UPSTREAM OF THE DELTA REGION

Feather River Basin

Oroville Reservoir

Impact 10.2.7-9: Decreases in Oroville Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Reductions in simulated end-of-month water surface elevation in Oroville Reservoir by more than six feet would occur the same number of times during March and April, three fewer times during May, and one more time during June under the CEQA No Project Alternative relative to the CEQA Existing Condition. Therefore, changes in water surface elevations that could occur under the CEQA No Project Alternative would result in a less than significant impact to Oroville Reservoir warmwater fisheries, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 456 through 467).

Impact 10.2.7-10: Decreases in Oroville Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Under the CEQA No Project Alternative, long-term average end of month storage is essentially equivalent from April through November, relative to the CEQA Existing Condition. Average storage by water year type is essentially equivalent for every month and water year type, with the exception of May during a critical year (1 percent higher). Therefore, changes in reservoir storage that could occur under the CEQA No Project Alternative would result in a less than significant impact to Oroville Reservoir coldwater fisheries, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pg. 406).

Lower Feather River

The following sections describe and discuss flow and water temperature differences between the CEQA No Project Alternative and the CEQA Existing Condition, and potential effects on fisheries and aquatic resources in the lower Feather River.

Over the entire simulation period for every month of the year, long-term average flows and water temperatures for all water year types, monthly mean flows and water temperatures, and the cumulative flow and water temperature distributions in the Low Flow Channel below the Fish Barrier Dam would be generally essentially equivalent under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Therefore, evaluations of potential impacts in the lower Feather River are restricted to below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River. Also, evaluations of potential impacts to green sturgeon include an examination of potential changes in flow at Shanghai Bench (Appendix F4, 2 vs. 1, pgs. 505 through 517 and 554 through 566).

Impact 10.2.7-11: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The analytical period for adult immigration and holding of spring-run Chinook salmon in the lower Feather River extends from March through October. Simulated flows below the Thermalito Afterbay Outlet would be higher by ten percent or more with about 2 percent probability during March and September, 3 percent probability during April and 8 percent probability during June. Simulated flows would be lower by ten percent or more with about 2, 3, 14 and 1 percent probability during March, April, May and August. Simulated flows below the Thermalito Afterbay Outlet would be essentially equivalent or measurably higher with about 60 to 100 percent probability during all months of this life stage. In fact, simulated flows would be measurably higher with more than 60 percent probability during June. During relatively low flow conditions, flows would be higher by ten percent or more with about 8, 12 and 28 percent probability during March, April and June. By contrast, during relatively low flow conditions, flows would be lower by ten percent or more with about 4 percent probability during March and August and 20 percent probability during May (Appendix F4, 2 vs. 1, pgs. 604 through 615 and 628 through 639).

Simulated flows at the mouth of the lower Feather River would be higher by ten percent or more with about 15, 20, 2 and 1 percent probability during May, June, July, and August, respectively. Simulated flows would be lower by ten percent or more with about 20, 35 and 1 percent probability during July, August and September, respectively. Simulated flows would be higher with about 40 to 50 percent probability during May and June. During March and April, simulated flows would be essentially equivalent with about 70 to 80 percent probability. During July through October, flow decreases would occur with about 60 to 95 percent probability. During relatively low flow conditions, flows would be higher by ten percent or more with about 28 percent probability during May, 72 percent probability during June, 8 percent probability during July and 4 percent probability during August. By contrast, during relatively low flow conditions, flows would be lower by ten percent or more with about 52 percent probability during July, 80 percent probability during August and 4 percent probability during September (Appendix F4, 2 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA No Project Alternative and the CEQA Existing Condition would be essentially equivalent or lower over the entire cumulative water temperature distributions during the March through October adult immigration and holding life stage period. During warmer temperature conditions, water temperatures under the CEQA No Project Alternative would be lower with about 8 percent probability during March and June, and with about 4 percent probability during May (Appendix F4, 2 vs. 1, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River under both the CEQA No Project Alternative and the CEQA Existing Condition would be generally equivalent or lower over the entire cumulative water temperature distributions during March through June. Water temperature increases would occur during July through October with about 85, 98, 5, and 2 percent probability, respectively. Under both alternatives, water temperatures always remain at or below the 60°F index value with approximately 99 percent probability during March, 40 percent probability during April, 15 percent probability during October, with only about a 1 percent probability during May, and always exceed the 60°F index value from June through September. During warmer temperature conditions, water temperatures would be measurably lower with about 4 percent probability during March and July, 48 percent probability during May and 20 percent probability during June. Water temperatures would be measurably higher during warmer temperature conditions with about 52 percent probability during July, 92 percent probability during August and 12 percent probability during September (Appendix F4, 2 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire March through October adult immigration and holding period below the Thermalito Afterbay Outlet, the CEQA No Project Alternative results in 1 decrease above the 60 and 68°F index values and 1 increase above the 64°F index value (Appendix F4, 2 vs. 1, pgs. 678 through 689). At the mouth of the lower Feather River, the CEQA No Project results in 1 increase above the 64°F index value. At the mouth of the Feather River, the CEQA No Project Alternative results in 3 increases above the 68°F index value, 2 increases above the 60°F index value and no additional increases above, or decreases below the 64°F index value (Appendix F4, 2 vs. 1, pgs. 825 through 836).

Because no clear distinction between spring- and fall-run Chinook salmon spawning could be derived from survey data collected in the lower Feather River, the spawning habitat analysis for potential impacts on the two runs was combined into one expanded spawning season (September through December) that was inclusive of all Chinook salmon spawning in the lower Feather River. Over the 71-year simulation period, the annual spawning habitat availability long-term average for Chinook salmon spawning in the lower Feather River under the CEQA Yuba Accord Alternative is similar to that under the CEQA Existing Condition (long-term average of 85.6 percent versus 85.4 percent of the maximum WUA) (Appendix F4, 2 vs. 1, pgs. 873).

The cumulative annual Chinook salmon spawning habitat availabilities under the CEQA Yuba Accord Alternative would be almost undistinguishable from those under the CEQA Existing Condition. Both the CEQA Yuba Accord Alternative and the CEQA Existing Condition would achieve over 90 percent of maximum WUA with about 30 percent probability, and both alternatives would achieve over 80 percent of maximum WUA with nearly 85 percent probability. Changes of 10 percent or more in annual spawning habitat availability would not occur (Appendix F4, 2 vs. 1, pg. 875).

During the September through December Chinook salmon spawning period, the CEQA No Project Alternative results in water temperatures below the Thermalito Afterbay Outlet that would be essentially equivalent to those under the CEQA Existing Condition

The embryo incubation life stage for Chinook salmon in the lower Feather River generally extends from September through February. Timing of fry emergence is primarily dependant on water temperature. As indicated above for the spawning life stage, water temperatures below the Thermalito Afterbay Outlet under the CEQA No Project Alternative would be nearly identical, to those under the CEQA Existing Condition during the September through December period. During January and February, water temperatures generally do not exceed 54°F, and therefore do not approach the lowest water temperature index value (56°F) below the Thermalito Afterbay Outlet under either the CEQA No Project Alternative or the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 678 through 689 and 702 through 713).

Long-term average early life stage survival estimates would be identical under the CEQA No Project Alternative and the CEQA Existing Condition (97.7 percent). Early life stage survival estimates do not differ by more than 0.2 percent for any individual year included in the 71-year period of analysis. Substantial reductions in salmon survival over three or more consecutive years are not observed between the CEQA No Project Alternative and the CEQA Existing Condition. Therefore, the CEQA No Project Alternative is not anticipated to affect potential future recruitment from a given spawning stock, which may in turn affect the population dynamics of subsequent generations (Appendix F4, 2 vs. 1, pg. 881).

Spring-run Chinook salmon juveniles are commonly reported to rear in their natal streams from 9 to 18 months. Specific habitat-discharge relationships for juvenile Chinook salmon rearing have not been developed for the lower Feather River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to Chinook salmon juveniles. Therefore, for impact assessment purposes, year-round examination of water temperatures is conducted to address potential juvenile spring-run Chinook salmon rearing in the lower Feather River.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA No Project Alternative would be essentially equivalent or lower to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. During warmer temperature conditions, water temperatures would be measurably lower with about 8 percent probability during March and June and 4 percent probability during May (Appendix F4, 2 vs. 1, pgs. 678 through 689 and 702 through 713).

Spring-run Chinook salmon smolt emigration reportedly occurs from October through June. Flows below the Thermalito Afterbay Outlet from October through June would be essentially equivalent or measurably higher with about 60 to 100 percent probability under the CEQA No Project Alternative and the CEQA Existing Condition. Simulated flows would be higher by ten percent or more with about 1, 2, 3 and 8 percent probability during December, March, April and June, respectively. Simulated flows would be lower by ten percent or more with about 12, 4, 2, 3 and 14 percent probability during November, January, March, April and May, respectively. During relatively low flow conditions, flows would be higher by 10 percent or more with about 4, 8, 12 and 28 percent probability during December, March, April and June, respectively. Simulated flows during relatively low flow conditions would be lower by 10 percent or more with 4 and 20 percent probability during March and May, respectively (Appendix F4, 2 vs. 1, pgs. 604 through 615 and 628 through 639).

Simulated flows at the mouth of the lower Feather River would be measurably higher with 40 to 60 percent probability during December, January, May and June under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Simulated flows during November, February, March and April would be essentially equivalent or measurably higher with about 70 to 90 percent probability. Measurably flow decreases would occur with approximately 80 percent probability during October. However, flow levels remain above 1,500 cfs under both alternatives with over 95 percent probability, and remain above 3,000 cfs with approximately 50 percent probability. Simulated flows at the mouth of the Feather River would be higher by 10 percent or more with approximately 4, percent during November, 22 percent during December, 17 percent during January, 3 percent during February, 14 percent during May and 20 percent during June. By contrast, simulated flows would be lower by 10 percent or more with approximately 2 percent during January. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 44 percent probability during January, 8 percent during February, 32 percent during May and 72 percent during June. January flows would be lower by 10 percent or more with about 8 percent probability during relatively low flow conditions (Appendix F4, 2 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA No Project Alternative would be essentially equivalent or lower to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the October through June smolt emigration period. During warmer temperature conditions, water temperatures would be measurably lower with about 8 percent probability during March and June and 4 percent probability during May (Appendix F4, 2 vs. 1, pgs. 675 through 689 and 702 through 713).

At the mouth of the lower Feather River, water temperatures under both the CEQA No Project Alternative and the CEQA Existing Condition would be generally below 60°F from November through March. Under the CEQA No Project Alternative, relative to the CEQA Existing Condition, water temperatures would be generally essentially equivalent or lower for November, February, March and April. During May and June, water temperatures would be measurably lower with over 27 and 5 percent probability. Water temperatures would be measurably higher with approximately 2, 4 and 7 percent probability during October, December and January. During warmer conditions, water temperatures would be measurably lower with approximately 4, 44 and 20 percent probability during March, May and June, respectively (Appendix F4, 2 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the spring-run Chinook salmon emigration life stage below the Thermalito Afterbay Outlet, the CEQA No Project Alternative, relative to the CEQA Existing Condition, results in one decrease below the 60°F index value, and no additional increases above, or decreases below, the 63, 68 and 70°F index values (Appendix F4, 2 vs. 1, pgs. 678 through 689). At the mouth of the Feather River, the CEQA No Project Alternative, results in 2 increases above the 60°F index value, 1 decrease below the 68°F index value and no additional increases above, or decreases below the 63 and 70°F index values (Appendix F4, 2 vs. 1, pgs. 825 through 836).

Based on instream flow, water temperature, spawning habitat availability and early life stage survival analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative is expected to provide:

- Generally equivalent or improved adult immigration and holding conditions due to: (1) equivalent or measurably higher flows with about 70 to 100 percent probability during all months of this life stage below the Thermalito Afterbay Outlet; (2) essentially equivalent water temperatures from March through October below the Thermalito Afterbay Outlet; (3) measurable flow increases during the lowest 40 to 50 percent of flow conditions during May and June at the mouth of the Feather River; and (4) measurably lower water temperatures under 40 percent of the warmest water temperature conditions during May at the mouth of the Feather River

- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period

- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates

- Equivalent over-summer rearing conditions due to nearly identical water temperatures below the Thermalito Afterbay Outlet

- Generally equivalent smolt emigration conditions due to: (1) generally equivalent flows and water temperatures from October through June below the Thermalito Afterbay Outlet; (2) equivalent or measurably higher flows with about 70 to 90 percent probability during all months of this life stage except for October at the mouth of the lower Feather River; (3) lower flows during October, although flows would remain at 1,500 cfs or more with approximately 95 percent probability, and above 3,000 cfs with approximately 50 percent probability at the mouth of the lower Feather River; (4) higher flows of ten percent or more at relatively low flow conditions at the mouth of the lower Feather River during January, February, May and June; and (5) essentially equivalent water temperatures from October through April, and during June, at the mouth of the Feather River, with measurably lower water temperatures during 40 percent of the warmest water temperature conditions during May

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon, the CEQA No Project Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River spring-run Chinook salmon.

Impact 10.2.7-12: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The adult immigration and holding life stage for fall-run Chinook salmon in the lower Feather River primarily extends from July through December. Simulated flows below the Thermalito Afterbay Outlet under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would be higher by ten percent or more with 2 and 1 percent probability during September and December, respectively. Simulated flows would be lower by ten percent or more with about 1 and 12 percent probability during August and November, respectively. Simulated flows below the Thermalito Afterbay Outlet would be essentially equivalent or measurably higher with a 60 to 99 percent probability during all months of this life stage. During relatively low flow conditions, flows would be lower by ten percent or more with abut 4 percent probability during August (Appendix F4, 2 vs. 1, pgs. 628 through 639).

Under the CEQA No Project Alternative, simulated flows at the mouth of the lower Feather River would be higher than the CEQA Existing Condition by ten percent or more with about 2, 1, 4, and 22 percent probability during July, August, November and December, respectively. Simulated flows would be lower by ten percent or more with about 20, 36 and 1 percent probability during July, August and September, respectively. Simulated flows would be essentially equivalent or measurably higher with about 80 to 90 percent probability during November and December. Simulated flows would be measurably lower with about 60 to 95 percent probability from July through October; however flows would be higher than 1,500 cfs with over 95 percent probability, and higher than 3,000 cfs with about 50 to 90 percent probability. During relatively low flow conditions, flows would be higher by ten percent or more with about 8 and 4 percent probability during July and August, respectively. By contrast, flows during relatively low flow conditions would be lower by 10 percent or more with about 52 percent probability during July, 60 percent probability during August and 4 percent probability during September (Appendix F4, 2 vs. 1, pgs. 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet would be essentially equivalent or lower for the CEQA No Project Alternative and the CEQA Existing Condition over the entire cumulative water temperature distributions during the July through December adult immigration and holding life stage period (Appendix F4, 2 vs. 1, pgs. 678 through 689 and 702 through 713).

November water temperatures at the mouth of the Feather River under both the CEQA No Project Alternative and the CEQA Existing Condition would be generally equivalent or lower over the entire cumulative water temperature distributions. The CEQA No Project Alternative, relative to the CEQA Existing Condition, results in measurable water temperature increases with about 95, 90, 5 and 2 during July, August, September, October and December, respectively. Under both alternatives, water temperatures always remain below the 60°F during November and December, and with approximately 15 percent probability during October. Simulated water temperatures always exceed 60°F during the rest of the adult immigration and holding period. In fact, under both alternatives, water temperatures always exceed the 68°F water temperature index value during July and August (Appendix F4, 2 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire July thorough December adult immigration and holding period below the Thermalito Afterbay Outlet, the CEQA No Project Alternative, relative to the CEQA Existing Condition, results in 1 increase above the 64°F index value, 1 decrease below the 68°F index value, and no additional increases above, or decreases below the 60°F index values. At the mouth of the lower Feather River , the CEQA No Project Alternative results in 1 increase above the 60°F index value, and no additional increases above, or decreases below the 64 and 68°F index values (Appendix G, 2 vs. 1, pgs. G-227 through G-228).

The adult spawning and embryo incubation life stage periodicities of fall-run Chinook salmon in the Feather River are not distinguished from those of the spring-run; therefore these life stages are not evaluated separately. For evaluation of Chinook salmon spawning and embryo incubation under the CEQA No Project Alternative, relative to the CEQA Existing Condition, see the discussion provided above under spring-run Chinook salmon.

The juvenile fall-run Chinook salmon rearing and outmigration period in the lower Feather River extends from November through June. Flows below the Thermalito Afterbay Outlet for all months of this life stage would be essentially equivalent or measurably higher with 65 to 100 percent probability under the CEQA No Project Alternative, relative to the CEQA Existing Condition. In fact, flows during June would be measurably higher with about 60 percent probability. For the entire cumulative flow distribution, simulated flows below the Thermalito Afterbay Outlet under the CEQA No Project Alternative, relative to the CEQA Existing Condition, do not change by ten percent or more, with more than about 15 percent probability during any month of the smolt emigration life stage. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 4 percent probability during December, 8 percent probability during March, 12 percent probability during April and 28 percent probability during June. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with 4 percent probability during March and 20 percent probability during May (Appendix F4, 2 vs. 1, pgs. 604 through 615 and 628 through 639).

Flows at the mouth of the lower Feather River would be measurably higher by 50 to 60 percent or more of the cumulative flow distribution during December, January and June under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Flows during November and from February through May would be essentially equivalent or measurably higher with about 70 to 90 percent probability. Simulated flows at the mouth of the Feather River would be higher by ten percent or more with about 5, 20, 15, 5, 15 and 20 percent probability during November, December, January, February, May and June, respectively. January flows would be lower by 10 percent or more with about 2 percent probability. During relatively low flow conditions, flows would be higher by 10 percent or more with 44 percent probability during January, 8 percent probability during February, 32 percent probability during May and 72 percent probability during June. January flows would be lower by 8 percent during relatively low flow conditions (Appendix F4, 2 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under the CEQA No Project Alternative and the CEQA Existing Condition would be essentially equivalent or lower over the entire cumulative water temperature distributions during the November through June juvenile rearing and outmigration life stage period. During relatively warm conditions, water temperatures would be measurably lower with about 8 percent probability during March and June and 4 percent probability during May (Appendix F4, 2 vs. 1, pgs. 678 through 689 and 702 through 713).

At the mouth of the lower Feather River, water temperatures under both the CEQA No Project Alternative and the CEQA Existing Condition would be generally below 60°F from November through March. Under the CEQA No Project Alternative, relative to the CEQA Existing Condition, water temperatures would be essentially equivalent November, February and April. Water temperatures would be measurably lower with about 1, 25, and 5 percent probability during March, May and June, respectively. During December and January, water temperatures would be essentially equivalent with about 95 percent probability, and measurably higher with about 5 percent probability. Nevertheless, as previously discussed, water temperatures during December and January remain below the 60°F index value. During warmer conditions, water temperatures would be measurably lower with approximately 4, 44 and 20 percent probability during March, May and June, respectively (Appendix F4, 2 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire November through June juvenile rearing and outmigration period below the Thermalito Afterbay Outlet, the CEQA No Project Alternative, relative to the CEQA Existing Condition results in 1 decrease below the 60°F index value and 2 increases above the 65°F index value. No additional increases above, or decreases below the 63, 68, 70 and 75°F index values would be associated with the CEQA No Project Alternative. At the mouth of the lower Feather River, the CEQA No Project Alternative results in 1 increase above the 60, 65 and 70°F index values, 1 decrease below the 63°F index value and 3 decreases below the 68°F index values (Appendix F4, 2 vs. 1, pgs. 678 through 689 and 825 through 836).

Based on instream flow, water temperature, spawning habitat availability and early life stage survival analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative is expected to provide:

- Generally equivalent or less suitable adult immigration and holding conditions due to: (1) relatively minor and infrequent changes in flows, and generally equivalent water temperatures throughout this life stage below the Thermalito Afterbay Outlet; (2) consistent decreases in flows from July through October, although flows almost always remain above 2,000 cfs from July through September, and above 1,500 cfs in October at the mouth of the Feather River; (3) relatively minor and infrequent changes in flows during November and December at the mouth of the Feather River; and (4) consistent (about 85 to nearly 100 percent of the time) but relatively small (< 1°F) warmer, and therefore less suitable, water temperatures at the mouth of the Feather River during July and August
- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period

- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates
- Generally equivalent or improved smolt emigration conditions due to: (1) generally equivalent flows and water temperatures from November through June below the Thermalito Afterbay Outlet; (2) generally equivalent flow conditions, with higher flows of ten percent or more at relatively low flow conditions at the mouth of the lower Feather River during January, February, May and June; and (3) essentially equivalent water temperatures from November through April, and during June, at the mouth of the Feather River, with measurably lower water temperatures during 40 percent of the warmest water temperature conditions during May

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon, the CEQA No Project Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River fall-run Chinook salmon.

Impact 10.2.7-13: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the lower Feather River extends from August through April. Simulated flows below the Thermalito Afterbay Outlet would be higher by ten percent or more with about 2 percent probability during September and March, 1 percent probability during December, and 3 percent probability during April. Simulated flows would be lower by ten percent or more with about 1, 12, 4, 2 and 3 percent probability during August, November, January, March and April, respectively. Simulated flows would be essentially equivalent or measurably higher with a 60 to 95 percent probability during all months of this life stage. During relatively low flow conditions, flows would be higher by ten percent or more with about 4 percent probability during December, 8 percent probability during March and 12 percent probability during April. Flows would be lower by ten percent or more during relatively low flow conditions with about 4 percent probability during August and March and 8 percent probability during January (Appendix F4, 2 vs. 1, pgs. 604 through 615 and 628 through 639).

Simulated flows at the mouth of the lower Feather River would be higher by ten percent or more with about 1, 5, 20, 15, and 5 percent probability during August, November, December, January and February, respectively. Simulated flows would be lower by ten percent or more with about 35, 1, and 2 percent probability during August, September and January, respectively. During December and January, simulated flows would be measurably higher with 60 to 65 percent probability. Simulated flows would be essentially equivalent or measurably higher with a 70 to 90 percent probability during November, February, March and April. During August through October, flows would be measurably lower with about a 60 to 95 percent probability. However, flow levels remain above 1,500 cfs under both alternatives with over 95 percent probability, and remain at or above 3,000 cfs with about 50 to 80 percent probability. During relatively low flow conditions, flows would be higher by ten percent or more with 4, 44 and 8 percent probability during August, January and February, respectively. Flows would be lower by ten percent or more during relatively low flow conditions with about 80, 4 and 8 percent probability during August, September, and January, respectively (Appendix F4, 2 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA No Project Alternative and the CEQA Existing Condition would be essentially equivalent or slightly lower over the entire cumulative water temperature distributions during the August through April adult immigration and holding life stage period (Appendix F4, 2 vs. 1, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River under both the CEQA No Project Alternative and the CEQA Existing Condition would be generally equivalent during November, February, March and April. Water temperatures would be measurably higher with about 98 percent probability during August, 5 percent probability during September, December and January, and 2 percent probability during October. Moreover, during relatively warm water temperatures, the CEQA No Project Alternative results in measurably higher water temperatures with approximately 92 and 12 percent probability during August and September, respectively. March water temperatures would be lower with 4 percent probability during relatively warm water temperatures. Under both alternatives, water temperatures generally exceed the 56°F index value during August, September, October and April. In fact, water temperatures under both alternatives exceed the 70°F index value with about 80 and 55 percent probability during August and September, respectively. Under both alternatives, water temperatures generally remain below 56°F during November through February, and remain below 56°F with about 75 percent probability during March (Appendix F4, 2 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire August through April adult immigration and holding period below the Thermalito Afterbay Outlet, the CEQA No Project Alternative, relative to the CEQA Existing Condition, results in no additional increases above, or decreases below the 52, 56 and 70°F index values (Appendix F4, 2 vs. 1, pgs. 678 through 689 and 702 through 713). At the mouth of the Feather River, the CEQA No Project Alternative results in 10 increases above the 70°F index value and no additional increases above, or decreases below the 52 and 56°F index values (Appendix G, 2 vs. 1, pg. G-228).

The primary analytical period for steelhead spawning extends from December through March. Over the 72-year simulation period, the annual spawning habitat availability long-term average for steelhead in the lower Feather River under the CEQA No Project Alternative is 0.3 percent higher that the CEQA Existing Condition (long-term average of 55.4 versus 55.1 percent of the maximum WUA) (Appendix F4, 2 vs. 1, pg. 876).

The cumulative annual steelhead spawning habitat availabilities under the CEQA No Project Alternative would be similar to those under the CEQA Existing Condition. Both the CEQA No Project Alternative and the CEQA Existing Condition would achieve over 90 percent of maximum WUA with about 10 percent probability. Changes of 10 percent or more in annual spawning habitat availability would not occur (Appendix F4, 2 vs. 1, pg. 878).

Under the CEQA No Project Alternative, water temperatures below the Thermalito Afterbay Outlet during the December through March steelhead spawning period would be essentially equivalent or measurably lower to water temperatures under the CEQA Existing Condition. Water temperatures below the Thermalito Afterbay Outlet during the December through May embryo incubation period also would be essentially equivalent or measurably lower to water temperatures under the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 678 through 689).

Steelhead are commonly reported to rear in their natal streams year round for up to two years. Specific habitat-discharge relationships for juvenile steelhead rearing have not been developed for the lower Feather River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles. Therefore, for impact assessment purposes, year-round examination of water temperatures is conducted to address potential impacts to juvenile steelhead rearing in the lower Feather River.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA No Project Alternative would be essentially equivalent or measurably lower to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period (Appendix F4, 2 vs. 1, pgs. 678 through 689 and 702 through 713).

Steelhead smolt emigration reportedly occurs from October through May. Flows below the Thermalito Afterbay Outlet from October through May would be essentially equivalent or measurably higher with approximately 60 to 95 percent probability under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Simulated flows below the Thermalito Afterbay Outlet would be higher by 10 percent or more with about 1, 2 and 5 percent probability during December, March and April, respectively. Simulated flows would be lower by 10 percent or more with about 10 percent probability during November, 5, percent probability during January and April, and 2 percent probability during March. During relatively low flow conditions, flows would be higher by 10 percent or more with about 4, 8 and 12 percent probability during December, March and April, respectively. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with 4 percent probability during March (Appendix F4, 2 vs. 1, pgs. 604 through 615 and 628 through 639).

Flows at the mouth of the lower Feather River would be measurably higher by about 60 to 65 percent probability during December and January under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Flows during November and February through May would be essentially equivalent or measurably higher with about 70 to 85 percent probability. Measurably flow decreases would occur with approximately 80 percent probability during October; however, flow levels under both alternatives remain above 1,500 cfs with about 95 percent probability, and remain above 3,000 cfs with approximately 50 percent probability. Flows would be higher by 10 percent or more with approximately 20 percent probability during December, 15 percent probability during January, 5 percent probability during February and 15 percent probability during May. January flows would be lower by 10 percent or more with about 2 percent probability. During relatively low flow conditions, flows would be higher by 10 percent or more with about 44 percent probability during January, 8 percent probability during February, 32 percent probability during May. January flows would be lower with about 8 percent probability during low flow conditions (Appendix F4, 2 vs. 1, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the CEQA No Project Alternative and the CEQA Existing Condition would be essentially equivalent or measurably lower over the entire cumulative water temperature distributions during the October through May smolt emigration life stage period (Appendix F4, 2 vs. 1, pgs. 678 through 689 and 702 through 713).

At the mouth of the lower Feather River, water temperatures under both the CEQA No Project Alternative and the CEQA Existing Condition would be generally below 52°F during December and January; thus, these months will not be further examined for this life stage. Under the CEQA No Project Alternative, relative to the CEQA Existing Condition, water temperatures would be essentially equivalent during February, March and April. During October, water temperatures would be measurably lower with about 1 percent probability and measurably higher with approximately 2 percent probability. May water temperatures would be essentially equivalent with approximately 75 percent probability, and would be measurably lower with approximately 25 percent probability. During warmer conditions, water temperatures would be measurably lower with approximately 4 percent probability during March and 44 percent probability during May (Appendix F4, 2 vs. 1, pgs. 825 through 836 and 849 through 860).

Overall, during the entire October through May steelhead smolt emigration period below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River, the CEQA No Project Alternative relative to the CEQA Existing Condition, does not result in additional increases above, or decreases below the 52, 55 and 59°F index values (Appendix F4, 2 vs. 1, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative would be expected to provide:

- Generally equivalent or less suitable adult immigration and holding conditions due to: (1) generally equivalent flow conditions during August and September, and from December through March, with flow decreases at intermediate to high flow conditions during the months of October, November and April below the Thermalito Afterbay Outlet; (2) consistent decreases in flows from August through October, although flows almost always remain above 2,000 cfs during August and September, and above 1,500 cfs in October at the mouth of the Feather River; (3) relatively minor and infrequent changes in flows during November, December, March and April at the mouth of the Feather River; (4) generally higher flows under relatively low flow conditions at the mouth of the lower Feather River during January and February; (5) generally equivalent water temperatures from August through April below the Thermalito Afterbay Outlet, and from September through April at the mouth of the Feather River; and (6) consistent (nearly 100 percent of the time) but relatively small (< 1°F) warmer, and therefore less suitable, water temperatures at the mouth of the Feather River during August

- Equivalent spawning conditions due to similar spawning habitat availability during the December through April adult spawning period

- Equivalent juvenile rearing conditions due to essentially equivalent water temperatures below the Thermalito Afterbay Outlet

- Generally equivalent smolt emigration conditions due to: (1) generally equivalent flows and water temperatures from October through May below the Thermalito Afterbay Outlet; (2) equivalent or measurably higher flows with about 70 to 90 percent probability during all months of this life stage except for October at the mouth of the lower Feather River; (3) lower flows during October, although flows would remain at 1,500 cfs or more with approximately 95 percent probability, and above 3,000 cfs with approximately 50 percent probability at the mouth of the lower Feather River; (4) higher flows of ten percent or more at relatively low flow conditions at the mouth of the lower Feather River during January, February and May; and (5) essentially equivalent water temperatures from October through April at the mouth of the Feather River, with measurably lower water temperatures during 40 percent of the warmest water temperature conditions during May

In conclusion, in consideration of potential impacts to all life stages of steelhead, the CEQA No Project Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River steelhead.

Impact 10.2.7-14: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect green sturgeon

The analytical period for green sturgeon adult immigration and holding extends from February through July. Under the CEQA No Project Alternative, relative to the CEQA Existing Condition, relatively minor and infrequent flow changes would occur during all months of this life stage below the Thermalito Afterbay Outlet (Appendix F4, 2 vs. 1, pgs. 604 through 615).

Under the CEQA No Project Alternative, relative to the CEQA Existing Condition, relatively minor and infrequent changes in flows would occur at Shanghai Bench from February through April. Flows would be measurably higher during the lowest 25 percent of flow conditions during May, and during the lowest 50 percent of flow conditions during June. By contrast, during July simulated flows would be measurably lower with about a 95 percent probability; however, flows would remain above 1,500 cfs over the entire cumulative flow distribution, and above 3,000 cfs with about a 90 percent probability (Appendix F4, 2 vs. 1, pgs. 727 through 738 and 751 through 762).

The CEQA No Project Alternative, relative to the CEQA Existing Condition, would be expected to result in relatively minor and infrequent changes in flows from February through April, with measurable flow increases during the lowest 40 and 50 percent flow conditions during May and June, respectively, at the mouth of the lower Feather River. By contrast, during July simulated flows would be measurably lower with about a 95 percent probability; however, flows would remain above 1,500 cfs over nearly the entire cumulative flow distribution, and above 3,000 cfs with about a 90 percent probability (Appendix F4, 2 vs. 1, pgs. 776 through 787 and 800 through 811).

The CEQA No Project Alternative, relative to the CEQA Existing Condition, would be expected to result in essentially equivalent water temperatures during all months of this life stage below the Thermalito Afterbay Outlet. At the mouth of the lower Feather River the CEQA No Project Alternative would result in essentially equivalent water temperatures from February through April, and during June, with measurably lower water temperatures during 40 percent of the warmest water temperature conditions during May; and consistent (about 85 to nearly 100 percent of the time) but relatively small (< 1°F) warmer, and therefore less suitable, water temperatures at the mouth of the Feather River during July. Overall, the CEQA No Project Alternative would not result in one decrease below the 61°F index value below the Thermalito Afterbay Outlet, and no increases above or decreases below the 61°F index value at the mouth of the lower Feather River during the adult immigration and holding life stage (Appendix F4, 2 vs. 1, pgs. 702 through 713 and 849 through 860).

Because the analytical period for green sturgeon adult spawning and embryo incubation (i.e., March through July) falls within the adult immigration and holding analytical period, the discussion of flows and water temperatures described above for the adult immigration and holding life stage applies to these life stages. Overall, for the adult spawning and embryo incubation life stages, the CEQA No Project Alternative would result in one decrease below the 68°F index value below the Thermalito Afterbay Outlet.

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Year-round flows below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather

River have been generally described above under the spring-run Chinook salmon, fall-run Chinook salmon, and steelhead life stage evaluations. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Feather River. In general, available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juveniles.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the CEQA No Project Alternative would be generally essentially equivalent to those under the CEQA Existing Condition over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period (Appendix F4, 2 vs. 1, pgs. 702 through 713).

Simulated water temperature conditions at the mouth of the lower Feather River under the CEQA No Project Alternative would be generally essentially equivalent to those under the CEQA Existing Condition over the entire cumulative water temperature distributions during November, and from February through June. During October, December, January and September, water temperatures would be essentially equivalent with about 95 percent probability, and measurably higher with about 5 percent probability. During July and August, water temperatures would be measurably higher with about 85 and 98 percent probability, respectively. From October through April, water temperatures generally remain below 66°F under both alternatives. Water temperatures during May and June remain at or below 66°F with about 50 and 10 percent probability, respectively. Water temperatures always exceed 66°F during July, August and September. During warmer conditions, water temperatures would be measurably lower with about 4 percent probability during March and July, 44 percent probability during May and 20 percent probability during June. By contrast, water temperatures would be measurably higher during warmer conditions with about 52, 92 and 12 percent probability during July, August and September, respectively. Nevertheless, the CEQA No Project Alternative, relative to the CEQA Existing Condition, actually results in 3 decreases below the 66°F index value (Appendix F4, 2 vs. 1, pgs. 849 through 860).

The juvenile emigration life stage generally extends from May through September. Trends in flows during this life stage are encompassed in the description above for spring-run Chinook salmon adult immigration and holding. Similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juvenile emigration. Because the analytical period for green sturgeon emigration falls within the juvenile rearing analytical period for this species, water temperatures under the CEQA No Project Alternative below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River, relative to the CEQA Existing Condition, also would be expected to provide similar conditions for the juvenile emigration life stage.

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative would be expected to provide:

- Generally equivalent adult immigration and holding, adult spawning and embryo incubation conditions because of corresponding upstream migration and spawning flow-related habitat availabilities, and generally adequate water temperatures during these life stages

- Generally equivalent or potentially less suitable over-summer rearing and juvenile emigration conditions due to: generally equivalent water temperatures below the Thermalito Afterbay Outlet; and frequent measurable increases in simulated water temperatures during July and August, when water temperatures are already stressful to these life stages at the mouth of the lower Feather River

In conclusion, in consideration of potential impacts to all life stages of green sturgeon, the CEQA No Project Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to lower Feather River green sturgeon.

Impact 10.2.7-15: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect American Shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Feather River. As discussed above for lower Yuba River American shad, shifting of proportional flows (lower Feather River flows/Sacramento River flows) may simply re-allocate shad from the Sacramento River to the lower Feather River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for American shad attraction into the lower Feather River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Feather River flow, measured at its mouth, to Sacramento River flow, measured downstream of its confluence with the Feather River, is the same during April, and is 0.2 percent higher during May and 0.4 percent higher during June, under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Under the CEQA No Project Alternative, during wet years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.1 percent lower during April, 0.2 percent lower during May, and 0.2 percent lower during June. During above normal years, the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.2 percent lower during April, 0.2 percent lower during May, and 0.5 percent lower during June. During below normal years, long-term average percentage of lower Feather River flow to Sacramento River flow does not change during April, and is 0.2 percent higher during May and 0.1 percent higher during June. During dry years, long-term average percentage of lower Feather River flow to Sacramento River flow does not change during April, and is 1.0 percent higher during May and 1.6 percent higher during June. During critical years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.2 percent higher during April, 2.8 percent higher during May, and 4.1 percent higher during June. American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 775 and 882).

Differences in water temperature between the Sacramento and lower Feather rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 1 additional occurrence (out of the 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Feather River mouth (Appendix F4, 2 vs. 1, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative would be expected to result in less than significant impacts to lower Feather River American shad.

Impact 10.2.7-16: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Feather River. Striped bass spawning and initial rearing in the lower Feather River extends from April through June. Proportionate flow changes resulting from implementation of the CEQA No Project Alternative relative to the CEQA Existing Condition during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Feather River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the CEQA No Project Alternative, relative to the CEQA Existing Condition.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 2 fewer occurrence (out of the 213 months included in the analysis) when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at Feather River mouth (Appendix F4, 2 vs. 1, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative would be expected to result in less than significant impacts to lower Feather River striped bass.

Impact 10.2.7-17: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail spawning, embryo incubation, and initial rearing life stages in the lower Feather River occur from February through May. Over the entire 72-year period of simulated February through May estimates of usable flooded area (UFA), long-term average UFA in the lower Feather River would be 0.1 percent lower under the CEQA No Project Alternative relative to the CEQA Existing Condition, with average estimates of UFA by water year type ranging from 0.3 percent higher during wet years to 0.9 percent lower during dry years. Changes of 10 percent or more in UFA would not occur over more than 10 percent of the cumulative UFA distributions (Appendix F4, 2 vs. 1, pgs. 879 through 880).

Over the entire 71-year simulation period, February through May monthly mean water temperatures below the Thermalito Afterbay Outlet, under both the CEQA No Project Alternative and CEQA Existing Condition remain within the 45 - 75°F range of water temperatures reported to be suitable for splittail spawning (Appendix F4, 2 vs. 1, pgs. 825 through 836).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative would be expected to result in less than significant impacts to Sacramento splittail in the lower Feather River.

SACRAMENTO RIVER BASIN

Sacramento River

The following sections describe and discuss flow and water temperature differences between the CEQA No Project Alternative and the CEQA Existing Condition, and potential effects on fisheries and aquatic resources in the Sacramento River immediately downstream of the Feather River confluence and at Freeport.

Model output demonstrates relatively minor, but measurable changes in flows in the Sacramento River downstream of the Feather River confluence. For example, over the 864 months simulated for the Sacramento River immediately below the Feather River confluence, only 15 monthly mean flows indicate that a 10 percent or greater change under the CEQA No Project Alternative, relative to the CEQA Existing Condition – four decreases of 12.1, 10.6, 12.3 and 10.4 percent would occur in August, while two increases of 10.9 and 11.9 percent would occur in December, one increase of 10.8 percent in January, five increases of 16.2, 11.0, 10.2, 13.1 and 10.6 percent in May, and three increases of 14.7, 14.3 and 13.8 percent in June. The cumulative flow distributions for the CEQA No Project Alternative and the CEQA Existing Condition demonstrate: generally equivalent flows during November, February, March and April; slight (generally < 4 percent) flow decreases 30 to 40 percent of the time during October and September primarily at low to intermediate flow levels; slight (generally < 5 percent) but frequent (about 90 percent of the time) flow decreases during July and August; and slight (generally < 5 percent) flow increases primarily at low to intermediate flow levels during December, January, May and June. Similar results are evident in the Sacramento River at Freeport, with two May mean flows presenting 10 percent or greater increases (15.6 and 13.1 percent), and three June mean flows presenting increases of 12.4, 12.7 and 12.5 percent, under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 907 through 918).

Water temperatures in the Sacramento River immediately downstream of the Feather River confluence generally remain similar under the CEQA No Project Alternative and the CEQA Existing Condition during most months, and would be essentially equivalent from September through April, and during June. During May, slight water temperature decreases would occur about 5 percent of the time when water temperatures range from about 67.5 to 68°F, whereas measurable water temperature increases would occur at various water temperature levels about 30 percent of the time during July and over 60 percent of the time during August - during both months, water temperature increases generally would not exceed 0.5°F (Appendix F4, 2 vs. 1, pgs. 957 through 968 and 981 through 992).

At Freeport, water temperatures would exhibit a similar pattern as that observed at the lower Feather River confluence, although measurable differences would occur less frequently. At Freeport, the cumulative water temperature distributions would be essentially equivalent under the CEQA No Project Alternative and the CEQA Existing Condition in all months with the exceptions of July and August, when water temperatures would be slightly warmer (generally < 0.4°F) under low to intermediate water temperature conditions only about 5 and 10 percent of the time, respectively (Appendix F4, 2 vs. 1, pgs. 1006 through 1017 and 1055 through 1066).

Impact 10.2.7-18: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect winter-run Chinook salmon

The winter-run Chinook salmon adult immigration and holding life stage occurs in the Sacramento River from December through July. The flow and water temperature differences described above, between the CEQA No Project Alternative and the CEQA Existing Condition would not be expected to substantially affect the Sacramento River winter-run Chinook salmon adult immigration and holding life stage because:

- By May, the majority of adult winter-run Chinook salmon returning to the Sacramento River to spawn have already migrated upstream of the lower Feather River confluence;
- Relatively minor and infrequent changes in flows and water temperatures would occur at the lower Feather River confluence and at Freeport during most months of this life stage (Appendix F4, 2 vs. 1, pgs. 883 through 894).; and
- Overall, for the 568 months included in the analysis, immediately downstream of the Feather River confluence the CEQA No Project Alternative relative to the CEQA Existing Condition results in 1 increase above the 60°F index value, and in 1 decrease below the 64°F and 68°F index values, with no increases above or decrease below any of the water temperature index values at Freeport.

The juvenile rearing and outmigration life stage extends from June through April. Relatively minor and infrequent changes in flows and water temperatures would occur during this life stage at Freeport. At the lower Feather River confluence, slight but frequent increases in water temperatures would occur during July and August. Overall, for the 781 months included in the analysis, immediately downstream of the Feather River confluence the CEQA No Project Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value, and in 2 increases above the 70°F index value, with no increases above or decrease below any of the water temperature index values at Freeport (Appendix F4, 2 vs. 1, pgs. 883 through 894, 957 through 968, 1006 through 1017, 1055 through 1066 and Appendix G, 2 vs. 1, pg. G-236).

In conclusion, in consideration of potential effects to all relevant life stages of winter-run Chinook salmon, the CEQA No Project Alternative would result in a less than significant impact to winter-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.7-19: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

Spring-run Chinook salmon adult immigration and holding extends from February through September. As discussed above, relatively minor and infrequent changes in flows and water temperatures would occur during this life stage at Freeport. At the lower Feather River confluence, slight but frequent increases in water temperatures would occur during July and August. Additionally, the CEQA No Project Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value, and in 1 decrease below the 64°F and 68°F index values immediately downstream of the Feather River confluence (Appendix F4, 2 vs. 1, pgs. 883 through 894, 957 through 968, 1006 through 1017, and 1055 through 1066). The slightly warmer water temperatures during July and August would be probably not of sufficient magnitude and/or frequency to substantively affect adult immigration and holding (Appendix G, 2 vs. 1, pg. G-238).

Juvenile rearing occurs year-round in the lower Feather River. Overall, for the 852 months included in the analysis immediately downstream of the Feather River confluence the CEQA No Project Alternative relative to the CEQA Existing Condition results in 1 increase above the 60°F index value, 2 increases above the 70°F index value, and in 1 decrease below the 68°F water temperature index value. The slightly warmer water temperatures during July and August would be probably not of sufficient magnitude and/or frequency to substantively affect juvenile rearing (Appendix F4, 2 vs. 1, pgs. 957 through 968 and 1055 through 1066).

Smolt emigration occurs from October through June. Overall, for the 639 months included in the analysis immediately downstream of the Feather River confluence, the CEQA No Project Alternative relative to the CEQA Existing Condition results in 1 increase above the 60°F index value, and in 1 decrease below the 68°F index value. Based on the flow and water temperature modeling results described above, the relatively equivalent October - June flows and water temperatures under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would not be expected to substantially affect spring-run Chinook salmon juvenile rearing and smolt emigration (Appendix F4, 2 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of spring-run Chinook salmon, the CEQA No Project Alternative would result in a less than significant impact to spring-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.7-20: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

Fall-run Chinook salmon adult immigration and holding extends from July through December. The flow and water temperature differences described above, between the CEQA No Project Alternative and the CEQA Existing Condition would not be expected to substantially affect the Sacramento River fall-run Chinook salmon adult immigration and holding life stage due to:

- Relatively minor and infrequent changes in flows and water temperatures during most months of this life stage at Freeport; and slight but frequent increases in water temperatures during July and August at the lower Feather River confluence; and
- Overall, for the 426 months included in the analyses, both immediately downstream of the Feather River confluence and at Freeport, the CEQA No Project Alternative relative to the CEQA Existing Condition would result in no additional increases above or decreases below the 60°F, 64°F or 68°F water temperature index values.

The juvenile rearing and outmigration extends from December through June. Overall, for the 497 months included in the analysis immediately downstream of the Feather River confluence, the CEQA No Project Alternative relative to the CEQA Existing Condition would result in only 1 increase above the 60°F index value, and in 1 decrease below the 68°F water temperature index value. Based on the flow and water temperature modeling results described above, the generally equivalent December through June flows and water temperatures under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would not be expected to substantially affect fall-run Chinook salmon juvenile rearing and outmigration (Appendix F4, 2 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of fall-run Chinook salmon, the CEQA No Project Alternative would result in a less than significant impact to fall-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.7-21: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect late fall-run Chinook salmon

Late fall-run Chinook salmon adult immigration and holding extends from October through April. Overall, for the 497 months included in the analysis immediately downstream of the Feather River confluence, the CEQA No Project Alternative relative to the CEQA Existing Condition would result in only 1 increase above the 60°F water temperature index value. Based on the flow and water temperature modeling results under the CEQA No Project Alternative relative to the No Project Alternative described above, the generally equivalent October through April flows and water temperatures would not be expected to substantially affect late fall-run Chinook salmon adult immigration and holding (Appendix F4, 2 vs. 1, pgs. 957 through 968 and 1055 through 1066).

Juvenile rearing and outmigration extends from April through December. Overall, for the 639 months included in the analysis immediately downstream of the Feather River confluence, the CEQA No Project Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value, 2 increases above the 70°F index value, and 1 decrease below the 68°F water temperature index value. Based on the generally equivalent flows, as well as generally equivalent water temperatures with the exception of slight but frequent water temperature increases during July and August, the CEQA No Project Alternative relative to the No Project Alternative would not be expected to substantially affect late fall-run Chinook salmon juvenile rearing and outmigration (Appendix F4, 2 vs. 1, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of late fall-run Chinook salmon, the CEQA No Project Alternative would result in a less than significant impact to late fall-run Chinook salmon, relative to the CEQA Existing Condition.

Impact 10.2.7-22: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect steelhead

In the Sacramento River, the steelhead adult immigration and holding life stage period extends from August through March, the juvenile rearing life stage occurs year-round, and the smolt emigration life stage extends from October through May. Overall, immediately downstream of the Feather River confluence, the CEQA No Project Alternative relative to the CEQA Existing Condition would result in 2 increases above the 70°F index value during the adult immigration and holding life stage, and in 6 increases above the 72°F index value and 1 decrease below the 68°F water temperature index value during the juvenile rearing life stage (Appendix F4, 2 vs. 1, pgs. 957 through 968). At Freeport, for the 852 months included in the analysis, the CEQA No Project Alternative relative to the CEQA Existing Condition would result in 1 increase above the 72°F index value during the juvenile rearing life stage (Appendix F4, 2 vs. 1, pgs. 1055 through 1066).

Based on the flow and water temperature modeling results under the CEQA No Project Alternative relative to the No Project Alternative discussed above, the slight but consistently warmer water temperatures during July and August, together with the relatively equivalent flows and water temperatures during the remaining months would not be expected to substantially affect steelhead adult immigration and holding, juvenile rearing, or smolt emigration (Appendix F4, 2 vs. 1, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of steelhead, the CEQA No Project Alternative would result in a less than significant impact to steelhead, relative to the CEQA Existing Condition.

Impact 10.2.7-23: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect green sturgeon

Green sturgeon adult immigration and holding extends from February through July, adult spawning and embryo incubation extend from March through July, juvenile rearing occurs year-round, and juvenile emigration occurs May through September. Overall, for the 355 months included in the analyses immediately downstream of the Feather River confluence, the CEQA No Project Alternative relative to the CEQA Existing Condition would result in 1 decrease below the 68°F water temperature index value during the adult spawning and embryo incubation life stages. Based on the flow and water temperature modeling results under the CEQA No Project Alternative relative to the No Project Alternative discussed above, the slight but consistently warmer water temperatures during July and August, together with the relatively equivalent flows and water temperatures during the remaining months of the year would not be expected to substantially affect green sturgeon adult immigration and holding, adult spawning and embryo incubation, or juvenile rearing and emigration (Appendix F4, 2 vs. 1, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of green sturgeon, the CEQA No Project Alternative would result in a less than significant impact to green sturgeon, relative to the CEQA Existing Condition.

Impact 10.2.7-24: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect American shad

American shad adult immigration and spawning extends from April through June. Based on the flow and water temperature modeling results under the CEQA No Project Alternative relative to the No Project Alternative discussed above, the relatively equivalent flows and water temperatures during April, May and June would not be expected to substantially affect American shad adult immigration and spawning. Additionally, for the 213 months included in the analysis immediately downstream of the Feather River confluence, the CEQA No Project Alternative relative to the CEQA Existing Condition would result in 1 increase above the 60°F index value (Appendix F4, 2 vs. 1, pgs. 957 through 965 and 1055 through 1066).

In conclusion, the CEQA No Project Alternative would result in a less than significant impact to American shad, relative to the CEQA Existing Condition.

Impact 10.2.7-25: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect striped bass

Striped bass adult spawning, embryo incubation and initial rearing extend from April through June. Based on the flow and water temperature modeling results under the CEQA No Project Alternative relative to the No Project Alternative discussed above, the relatively equivalent flows and water temperatures during April, May and June would not be expected to substantially affect striped bass adult spawning, embryo incubation and initial rearing. Additionally, for the 213 months included in the analysis immediately downstream of the Feather River confluence, the CEQA No Project Alternative relative to the CEQA Existing Condition would result in 1 decrease below the 68°F index value (Appendix F4, 2 vs. 1, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the CEQA No Project Alternative would result in a less than significant impact to striped bass, relative to the CEQA Existing Condition.

Impact 10.2.7-26: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail adult spawning, embryo incubation and initial rearing extend from February through May. Over the 72-year simulation period, the frequency with which the Yolo Bypass floodplains would be inundated with Sacramento River water would be the same under the CEQA No Project Alternative relative to the CEQA Existing Condition. In the Sacramento River immediately downstream of the lower Feather River confluence, the CEQA No Project Alternative would provide no additional month (out of 288 Februaries, Marches, Aprils and Mays included in the analysis) with monthly mean flows greater than 56,000 cfs. These results suggest that the availability of splittail spawning, egg incubation, and initial rearing habitat would be essentially the same under the CEQA No Project Alternative and the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 883 through 894).

Over the 72-year simulation period, the February through May monthly mean water temperatures on the Sacramento River immediately downstream of the lower Feather River confluence under both the CEQA No Project Alternative and the CEQA Existing Condition would always be within the suitable range (i.e., 45°F to 75°F) for splittail spawning (Appendix F4, 2 vs. 1, pgs. 957 through 968).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the CEQA Existing Condition, the CEQA No Project Alternative would result in a less than significant impact to Sacramento splittail.

DELTA REGION

The evaluation of biological impacts on delta fisheries resources and their habitats use parameters established by the USFWS, CDFG, NMFS and others, including X2 locations, Delta outflows and E/I ratios, presented below.

X2 Location

Over the entire 72-year period of simulated X2 locations, long-term average X2 locations ranges from 0.2 km higher during September to 0.2 km lower during February under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Under the CEQA No Project Alternative, average X2 location by water year type ranges from: 0.3 km higher during September to 0.1 km lower during December and January in wet years; 0.3 km higher during September to 0.1 km lower during December through March in above normal years; 0.2 km higher during August and September to 0.3 km lower during February in below normal years; 0.2 km higher during September to 0.4 km lower during February in dry years; and 0.1 km higher during October, November, and January to 0.3 km lower during June and July in critical years (Appendix F4, 2 vs. 1, pg. 1189).

Cumulative X2 location distributions for the CEQA No Project Alternative and the CEQA Existing Condition generally overlap during each month of the year, indicating that the X2 location under each scenario would be downstream of compliance points in the Delta with nearly equal probabilities. Although rare, monthly mean X2 location does occasionally change by 1.0 km or more, including the following occasions: (1) one downstream movement (1.2 km) during December; (2) three downstream movements (1.3 km, 1.2 km, and 2.1 km) during

January; (3) three downstream movements (1.3 km, 1.2 km, and 1.1 km) during February; (4) two downstream movements (1.2 km and 1.1 km) during June; and (5) one upstream movement (1.1 km) during September. Changes in X2 location of 1.0 km or more result in the downstream movement of X2 past the designated compliance point of the Confluence on 1 occasion (Appendix F4, 2 vs. 1, pgs. 1214 through 1225).

Over the entire 72-year simulation period during the delta smelt spawning season (February through June), the CEQA No Project Alternative relative to the CEQA Existing Condition, results in a 0.5 km or greater upstream shift while X2 is located between Chipps Island and the Confluence compliance points during 1 out of 360 months included in the analysis, and downstream shifts during 16 out of 360 months. These upstream/downstream shifts occurred 10 times during February and 7 times during June (Appendix F4, 2 vs. 1, pgs. 1190 through 1201).

Delta Outflow

Over the entire 72-year period of simulated Delta outflow, long-term average Delta outflow ranges from 1 percent higher during November through January percent to 2 percent lower during July and August under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Under the CEQA No Project Alternative, average Delta outflow by water year type ranges from: 1 percent higher during November and December to 3 percent lower during August in wet years; 3 percent higher during November to 4 percent lower during August in above normal years; 3 percent higher during January to 3 percent lower during August in below normal years; 3 percent higher during December and January to 2 percent lower during August in dry years; and 5 percent higher during May to 1 percent lower during December in critical years (Appendix F4, 2 vs. 1, pg. 1140).

Over the 72-year period of simulation the CEQA No Project Alternative, relative to the CEQA Existing Condition, results in increases in the percentage of Delta outflows of 5 percent or more in 40 out of 864 months included in the analysis, and decreases of 5 percent or more in 15 out of 864 months (Appendix F4, 2 vs. 1, pgs. 1141 through 1152).

Export-to-Inflow Ratio

Delta E/I ratio limits are built into the CALSIM modeling assumptions and, therefore, are consistently met under both the Proposed Action and Environmental Baseline during all months of the year. Nevertheless, over the entire 72-year period of simulated E/I ratios, long-term average E/I ratio ranges from 1 percent higher during June to 1 percent lower during January and July under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pg. 1238). Under the CEQA No Project Alternative, average E/I ratio by water year type ranges from no change during all months except July, which is lower by 1 percent in wet years; no change during all months except July and August, which would be lower by 1 percent in above normal years; no change during all months except December and January, which would be lower by 1 percent in below normal years; 1 percent higher during June to 1 percent lower during December, January, and August in dry years; and 3 percent higher during June to 1 percent lower during January in critical years. Over the 72-year period of simulation the CEQA No Project Alternative, relative to the CEQA Existing Condition, results in a maximum increase of 5 percent, and a maximum decrease of 5 percent in the E/I ratios during any month included in the analysis (Appendix F4, 2 vs. 1, pgs. 1239 through 1250).

Salvage Estimation

Delta Smelt

The combined overall estimated salvage for delta smelt at the CVP and SWP salvage facilities increases by 0.5 percent under the CEQA No Project Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type changes by: (1) 0.3 percent decrease during wet years; (2) 1.0 percent decrease in above normal years; (3) 0.2 percent decrease during below normal years; (4) 2.5 percent increase during dry years; and (5) 5.0 percent increase during critical years, under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pg. 1336).

Winter-run Chinook Salmon

The combined overall estimated salvage for winter-run Chinook salmon at the CVP and SWP salvage facilities decreases by 0.1 percent under the CEQA No Project Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type changes by: (1) 0.1 percent decrease during wet years; (2) no change in above normal years; (3) 0.1 percent decrease during below normal and dry years; and (4) 0.2 percent decrease during critical years, under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pg. 1324).

Spring-run Chinook Salmon

The combined overall estimated salvage for spring-run Chinook salmon at the CVP and SWP salvage facilities decreases by 0.1 percent under the CEQA No Project Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type changes by: (1) 0.1 percent decrease during wet and above normal years; and (2) no change during below normal, dry, and critical years, under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pg. 1324).

Steelhead

The combined overall estimated salvage for steelhead at the CVP and SWP salvage facilities decreases by 0.1 percent under the CEQA No Project Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type changes by: (1) 0.2 percent decrease during wet years; (2) no change during above normal years; (3) 0.1 percent decrease during below normal and dry years; and (4) no change during critical years, under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pg. 133).

Striped Bass

The combined overall estimated salvage for striped bass at the CVP and SWP salvage facilities increases by 0.1 percent under the CEQA No Project Alternative, relative to the CEQA Existing Condition. The combined estimated salvage by water year type changes by: (1) 2.7 percent decrease during wet years; (2) 2.6 percent decrease during above normal years; (3) 0.4 percent decrease during below normal years; (4) 3.1 percent increase during dry years; and (5) 11.5 percent increase during critical years, under the CEQA No Project Alternative, relative to the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 1334 through 1335).

Impact 10.2.7-27: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect delta smelt

Model results indicate 16 (out of 360) months during which X2 shifts downstream by 0.5 km or more, and only 1 upstream shift of 0.5 km or more, while X2 is located between Chipps Island and the Confluence compliance points in response to implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, as described above. These shifts occurred 10 times during February and 7 times during June.

Relative to the CEQA Existing Condition, the CEQA No Project Alternative results in increases in the percentage of Delta outflows of 5 percent or more in 40 out of 864 months included in the analysis, and decreases of 5 percent or more in 15 out of 864 months. Changes in the E/I ratio would be relatively infrequent and of minor magnitude under the CEQA No Project Alternative, relative to the CEQA Existing Condition. However, overall estimated delta smelt salvage at the CVP and SWP facilities increases by 0.5 percent, with increases in salvage of 2.5 percent during dry years, and 5.0 percent during critical years under the CEQA No Project Alternative, relative to the CEQA Existing Condition.

Although changes in Delta habitat evaluation parameters exhibit an overall improvement for delta smelt, an overall increase in salvage, and particularly increases during dry and critical years, potentially could affect this species. Therefore, based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated delta smelt salvage, the CEQA No Project Alternative, relative to CEQA Existing Condition, could result in a potentially significant impact to delta smelt (Appendix F4, 2 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.7-28: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect winter-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA No Project Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect winter-run Chinook salmon habitat. In addition, overall estimated winter-run Chinook salmon salvage at the CVP and SWP facilities would decrease by 0.1 percent, and increases in average salvage by water year type would not occur, under the CEQA No Project Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated winter-run Chinook salmon salvage, the CEQA No Project Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to winter-run Chinook salmon (Appendix F4, 2 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.7-29: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect spring-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA No Project Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect spring-run Chinook salmon habitat. In addition, overall estimated spring-run Chinook salmon salvage at the CVP and SWP facilities would decrease by 0.1 percent, and increases in average salvage by water year type would not occur, under the CEQA No Project Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated spring-run Chinook salmon salvage, the CEQA No

Project Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to spring-run Chinook salmon (Appendix F4, 2 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.7-30: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect steelhead

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA No Project Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect steelhead habitat. In addition, overall estimated steelhead salvage at the CVP and SWP facilities would decrease by 0.1 percent, and increases in average salvage by water year type would not occur, under the CEQA No Project Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated steelhead salvage, the CEQA No Project Alternative, relative to CEQA Existing Condition, would result in a less than significant impact to steelhead (Appendix F4, 2 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.7-31: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect striped bass

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the CEQA No Project Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect striped bass habitat. However, overall estimated striped bass salvage at the CVP and SWP facilities would increase by 0.4 percent, with increases in salvage of 3.1 percent during dry years, and 11.5 percent during critical years under the CEQA No Project Alternative, relative to the CEQA Existing Condition.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated striped bass salvage, the CEQA No Project Alternative, relative to CEQA Existing Condition, would result in less than significant impact to striped bass (Appendix F4, 2 vs. 1, pgs. 1140, 1189, and 1238).

Impact 10.2.7-32: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) could affect other Delta fisheries resources

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, as described above under the CEQA No Project Alternative relative to the CEQA Existing Condition, would not be expected to substantially affect other Delta fisheries resources habitats. In conclusion, the CEQA No Project Alternative, relative to the CEQA Existing Condition would result in a less than significant impact to other Delta fisheries resources (Appendix F4, 2 vs. 1, pgs. 1140, 1189, and 1238).

EXPORT SERVICE AREA

San Luis Reservoir

Impact 10.2.7-33: Decreases in San Luis Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Simulated decreases in water surface elevation by more than 6 feet per month would occur the same number of times during March through June under the CEQA No Project Alternative relative to the CEQA Existing Condition. Therefore, changes in water surface elevations that could occur under the CEQA No Project Alternative would result in a less than significant impact to San Luis Reservoir warmwater fisheries, relative to the CEQA Existing Condition.

Impact 10.2.7-34: Decreases in San Luis Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

End of month storage volumes under the CEQA No Project Alternative do not change during any month in any year type relative to the CEQA Existing Condition. Therefore, changes in reservoir storage that could occur under the CEQA No Project Alternative would result in a less than significant impact to San Luis Reservoir coldwater fisheries, relative to the CEQA Existing Condition.

10.2.7.2 NEPA No Action Alternative Compared to the NEPA Affected Environment

In the Yuba Region, the primary differences between the NEPA No Action Alternative and the NEPA Affected Environment would be the changes in lower Yuba River flows associated with the implementation of the RD-1644 Long-term instream flow requirements, to replace the RD-1644 Interim instream flow requirements, and the increased local surface water demands for the Wheatland Water District. These also are the primary differences that would occur in the Yuba Region between the CEQA No Project Alternative and the CEQA Existing Condition. The potential effects to fisheries and aquatic resources that were evaluated in the quantitative analyses that is presented in Section 10.2.7.1 above for the CEQA No Project Alternative relative to the CEQA Existing Condition (see also Appendix F4, 2 vs. 1) therefore also are used for comparison of the NEPA No Action Alternative relative to the NEPA Affected Environment, and are not repeated here.

As discussed above, the analysis of the NEPA No Action Alternative includes several additional proposed projects in the project study area that are not included in the CEQA analysis. However, these other proposed projects would not significantly affect hydrologic conditions or fisheries resources in the Yuba Region and, thus, are only discussed in the context of CVP/SWP operations upstream of and within the Delta.

Under the NEPA No Action Alternative, future levels of demand for water in California would be addressed through the implementation of numerous projects, including water storage and conveyance projects (e.g., SDIP[17]), water transfers and acquisition programs (e.g., a long-term EWA Program or a program equivalent to the EWA), and other projects related to CVP/SWP system operations (e.g., CVP/SWP Intertie and FRWP).

Future changes in operations of water storage and conveyance projects, water transfers and acquisition programs, and other projects related to CVP/SWP system operations could result in operational changes for the CVP, SWP, and local water supply systems, and could result in new diversions from upstream or Delta sources. Water projects (e.g., a long-term EWA Program or a program equivalent to the EWA) could purchase water through groundwater substitution programs. As presently contemplated, water held in reservoirs during April through June

[17] The SDIP includes a maximum pumping rate of 8,500 cfs at the Banks Pumping Plant.

generally would be released during July through September under such programs. Except for the EWA Program (or its future equivalent), no other water transfer programs are currently managing water that would shift the timing of water deliveries, and none are likely to do so (Reclamation *et al.* 2003). Agencies participating in groundwater substitution programs or other water transfer programs could cause reservoirs to release more water during July through September than what is currently released under the Affected Environment. Thus, because end-of-September carry-over storage in reservoirs that would be affected by these projects and programs most likely would be lower, and the magnitude and timing of subsequent releases could be altered.

Other specific operational changes that could result from the range of these types of future projects currently contemplated would evolve over time as the details of these projects are refined. The general changes that may occur and that could affect special-status and other fish species include:

- Increased surface water diversions and storage;
- Improved water supply reliability and water management flexibility;
- Requirements for compatibility with objectives and continued improvement of Delta water quality;
- Improvements in reservoir coldwater pool management to maintain lower Sacramento River water temperatures;
- Reduced water diversions from the Sacramento River during critical fish migration periods;
- Expanded pumping capacity at the Banks pumping facility, along with improved fish screening mechanisms; and
- Modified Delta Cross Channel operation and screens.

As with conditions under the NEPA Affected Environment, actions to protect fisheries and aquatic resources in the CVP/SWP system that are mandated by existing regulatory requirements would continue in the future under the NEPA No Action Alternative. Under this alternative, Reclamation and DWR would continue to comply with the 2004/2005 OCAP BOs or successor documents developed by USFWS and NMFS under the Endangered Species Act to protect listed fish species in the CVP/SWP system.

Nevertheless, future CVP/SWP system operational changes under the NEPA No Action Alternative could affect north of Delta hydrology by altering reservoir storage volumes, river flow and water temperature patterns (timing, magnitude and frequency), as well as Delta inflows, outflows, X2 location and exports. Such changes could cause reduced stream flows or Delta outflows, changed seasonal flows, more water temperature variability, and changes in Delta salinity conditions that could result in effects on fish species. Reasonably foreseeable water acquisition programs and diversion projects under the NEPA No Action Alternative have the potential to reduce flows on the lower Sacramento River and inflows to the Delta which, in turn, have the potential to affect water temperatures in the lower Sacramento River, and Delta outflows, X2 location and other Delta habitat suitability parameters. Compared to conditions that are in place as part of the NEPA Affected Environment, potential factors that may affect fisheries and aquatic resources in the future may include reduced habitat abundance, impaired species movement, increased direct mortality of fish from diversions, and geographic relocations or restrictions of fish to less suitable habitats. Conveyance program actions could result in reduced frequency and magnitude of net natural flow conditions in the south and central Delta, resulting in reduced system productivity, impaired species movement, and increased loss from diversions.

10.2.8 Environmental Impacts/Environmental Consequences of the NEPA Yuba Accord Alternative Compared to the NEPA No Action Alternative

10.2.8.1 Yuba Region

New Bullards Bar Reservoir

Impact 10.2.8-1: Decreases in New Bullards Bar Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June, with the majority of warmwater fish spawning occurring during the months of April and May. Decreases in the water surface elevation of New Bullards Bar Reservoir by more than 6 feet per month from March through June would occur 10 times less often under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs. 75 through 86). Reduction in the frequency of potential nest dewatering events is expected to result in increased nest success and contribute to self-sustaining warmwater fish populations. Therefore, impacts upon warmwater fisheries that may be present in New Bullards Bar Reservoir from potential changes in water surface elevation under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative may be beneficial.

Impact 10.2.8-2: Decreases in New Bullards Bar Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

The NEPA Yuba Accord Alternative results in long-term average New Bullards Bar Reservoir storage of approximately 809 TAF in April to 550 TAF in November (Appendix F4, 6 vs. 5, pg. 1). This reduction corresponds to a change in water surface elevation from approximately 1,920 feet msl to 1,850 feet msl. Under the NEPA No Action Alternative, the November long-term average storage in New Bullards Bar Reservoir is approximately 599 TAF with a corresponding elevation of 1,865 feet msl (Appendix F4, 6 vs. 5, pg. 50).

Anticipated reductions in reservoir storage associated with the NEPA Yuba Accord Alternative would not be expected to adversely impact the New Bullards Bar Reservoir's coldwater fisheries because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample coldwater pool reserves. Throughout the period of operations of New Bullards Bar Reservoir (1969 through present), which encompasses the most extreme critically dry year on record, the coldwater pool in New Bullards Bar Reservoir has not been depleted. In fact, since 1993, coldwater pool availability in New Bullards Bar Reservoir has been sufficient to accommodate year-round utilization of the lower river outlets from the dam to the New Colgate tunnel, at the direction provided by CDFG, provide the coldest water possible to the lower Yuba River. Therefore, potential reductions in coldwater pool storage would not be expected to adversely affect New Bullards Bar Reservoir's coldwater fisheries because: (1) coldwater habitat would remain available in the reservoir during all months of the NEPA Yuba Accord Alternative; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fish. Therefore, changes in end-of-month storage that could occur under the NEPA Yuba Accord Alternative would result in a less than significant impact on New Bullards Bar Reservoir coldwater fisheries, relative to the NEPA No Action Alternative.

Lower Yuba River

Examination of hydrologic and water temperature model output for the lower Yuba River indicates nearly identical flow and water temperature results, and therefore relative differences of comparison, between the NEPA Yuba Accord Alternative compared to the NEPA No Action Alternative, and the CEQA Yuba Accord Alternative compared to the CEQA No Project Alternative. Although extremely rare, relative differences between the comparisons, when they would occur, would be minor and generally smaller when the NEPA Yuba Accord Alternative is compared to the NEPA No Action Alternative, relative to the differences between the CEQA Yuba Accord Alternative compared to the CEQA No Project Alternative. Therefore, trends in evaluation parameters previously presented for the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative would be the same as for this comparison, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, and are not repeated here. Moreover, the species-specific impact conclusions also are the same, and are summarized as follows (Appendix F4, 6 vs. 5).

Impact 10.2.8-3: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

In consideration of potential impacts to all life stages of spring-run Chinook salmon, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would result in a less than significant impact to lower Yuba River spring-run Chinook salmon.

Impact 10.2.8-4: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

In consideration of potential impacts to all life stages of fall-run Chinook salmon, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would result in a less than significant impact to lower Yuba River fall-run Chinook salmon.

Impact 10.2.8-5: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect steelhead

In consideration of potential impacts to all life stages of steelhead, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would result in a less than significant impact to lower Yuba River steelhead.

Impact 10.2.8-6: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect green sturgeon

In consideration of potential impacts to all life stages of green sturgeon, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would result in a less than significant impact to lower Yuba River green sturgeon.

Impact 10.2.8-7: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect American shad

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative would result in a less than significant impact to lower Yuba River American shad.

Impact 10.2.8-8: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect striped bass

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative would result in a less than significant impact to lower Yuba River striped bass.

10.2.8.2 CVP/SWP UPSTREAM OF THE DELTA REGION

FEATHER RIVER BASIN

Oroville Reservoir

Impact 10.2.8-9: Decreases in Oroville Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Reductions in simulated end-of-month water surface elevation in Oroville Reservoir by more than six feet would occur the same number of times during March and April, one more time during May, and one less time during June under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative. These reductions in water surface elevations would not be anticipated to result in substantial reductions in warmwater fish spawning success, because the results suggest that these potential decreases in water surface elevation would not be expected to occur during more than one month of any spawning season. In addition, a 60 percent nest success rate or greater would be achieved during some months of any annual spawning season, which would be expected to provide sufficient recruitment of individuals into the population over the 72-year simulation period. Therefore, changes in reservoir water surface elevation that could occur under the NEPA Yuba Accord Alternative would result in a less than significant impact on Oroville Reservoir warmwater fisheries, relative to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs. 456 through 467).

Impact 10.2.8-10: Decreases in Oroville Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Under the NEPA Yuba Accord Alternative, long-term average end of month storage is essentially equivalent from April through November, relative to the NEPA No Action Alternative. Average end of month storage by water year type also is essentially equivalent for most months of the April through November period, for all water year types, with the following exceptions: a 1 percent increase during June in above normal and critical years; and a 1 percent decrease during August and November in below normal years. These minor and infrequent changes in end-of-month reservoir storage that could occur under the NEPA Yuba Accord

Alternative would result in a less than significant impact on Oroville Reservoir coldwater fisheries, relative to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pg. 406).

Lower Feather River

The following sections describe and discuss flow and water temperature differences between the NEPA Yuba Accord Alternative and the NEPA No Action Alternative, and potential effects on fisheries and aquatic resources in the lower Feather River.

Over the entire simulation period for every month of the year, long-term average flows and water temperatures for all water year types, monthly mean flows and water temperatures, and the cumulative flow and water temperature distributions in the Low Flow Channel below the Fish Barrier Dam would be essentially equivalent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. Therefore, evaluations of potential effects in the lower Feather River are restricted to below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River (Appendix F4, 6 vs. 5, pgs. 505 through 517 and 554 through 566).

Impact 10.2.8-11: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The analytical period for adult immigration and holding of spring-run Chinook salmon in the Feather River extends from March through October. Simulated flows below the Thermalito Afterbay Outlet would be essentially equivalent or measurably higher ranging from about a 70 percent to 100 percent probability all months of this life stage with the exception of April and June. During April, measurable flow decreases would occur at intermediate to high flow levels. During June, flow decreases consistently would occur across most of the cumulative flow distribution, but remain above about 1,500 cfs about 90 percent of the distribution, and above 3,000 cfs for about 80 percent of the distribution. Simulated flows below the Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative, relative to under the NEPA No Action Alternative would be higher by ten percent or more with about a 5 percent probability during May, a 1 percent probability during June, a 10 percent probability during July, a 2 percent probability during August, and a 2 percent probability during September, and would be lower by ten percent or more 3 percent during April, about 20 percent during June, and 2 percent during September. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 4 percent probability during May and June and nearly a 45 percent probability during July. By contrast, during relatively low flow conditions flows would not be lower by 10 percent or more during this life stage except for during June and September when flows would be lower by 10 percent or more with about a 65 and 10 percent probability, respectively (Appendix F4, 6 vs. 5, pgs. 604 through 615 and 628 through 639).

Flows at the mouth of the Feather River exhibit general similar trends to those observed at the Thermalito Afterbay Outlet location with the notable exceptions of: (1) additional measurable flow increases during October, particularly during relatively low flow conditions; (2) flow decreases of ten percent or more at intermediate to low flow conditions during May, although flows would remain at or above 2,000 cfs about 95 percent of the time; (3) consistently higher flows over nearly the entire cumulative flow distribution during July and August; and (4) measurably higher flows during September, particularly during intermediate and low flow conditions. Fish exhibiting the typical life history of the spring-run are found holding at the Thermalito Afterbay Outlet and the Fish Barrier Dam as early as March (DWR 2004d), and most would be expected to have migrated upstream by June (Appendix F4, 6 vs. 5, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative would be essentially equivalent over the entire cumulative water temperature distributions during the March through October adult immigration and holding life stage period, except for measurable decreases occurring with about a 5 percent probability in July and measurable increases occurring with about a 10 percent probability in June and a 1 percent probability in September. Under both alternatives, water temperatures always remain below the 60°F index value during March, and remain below the 60°F index value with about a 90 percent probability during April, with only about a 15 percent probability during May, and nearly always exceed the 60°F index value from June through September. In fact, water temperatures exceed the 68°F water temperature index value with about a 55 and 50 percent probability during July and August, respectively (Appendix F4, 6 vs. 5, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River would be generally warmer than at Thermalito Afterbay Outlet during each month of the March through October adult immigration and holding life stage, particularly during the warm summer months of June through September, when water temperatures at the mouth of the Feather River would be frequently 1 – 4°F warmer than at the Thermalito Afterbay Outlet, under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative. At the mouth of the Feather River, water temperatures under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would be generally equivalent during March, April, June, September and October. During May, water temperatures would be measurably warmer at intermediate to warm water temperature conditions. During July and August, water temperatures under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative always exceed the 68°F water temperature index value, although water temperatures under the NEPA Yuba Accord Alternative would be consistently about 0.3 to about 1°F cooler than the NEPA No Action Alternative, when temperatures are stressful to this species and life stage (Appendix F4, 6 vs. 5, pgs. 825 through 836 and 849 through 860).

Overall, during the entire March through October adult immigration and holding period below the Thermalito Afterbay Outlet, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in no changes at the 60°F index value, 1 decrease below the 64°F index value, and 4 increases at the 68°F index value (Appendix F4, 6 vs. 5, pgs. 678 through 689). At the mouth of the Feather River, the NEPA Yuba Accord Alternative results in 1 decrease below the 60°F index value and no changes at either the 64°F or 68°F index values (Appendix F4, 6 vs. 5, pgs. 825 through 836).

Because no clear distinction between spring- and fall-run Chinook salmon spawning could be derived from survey data collected in the Feather River, the spawning habitat analysis for potential impacts on the two runs was combined into one expanded spawning season (September through December) that was inclusive of all Chinook salmon spawning in the Feather River. Over the 71-year simulation period, the annual spawning habitat availability long-term average for Chinook salmon spawning in the Feather River under the NEPA Yuba Accord Alternative is nearly identical to that under the NEPA No Action Alternative (long-term average of 84.4 percent versus 84.6 percent of the maximum WUA) (Appendix F4, 6 vs. 5, pg. 873).

The cumulative annual Chinook salmon spawning habitat availabilities under the NEPA Yuba Accord Alternative are almost undistinguishable from those under the NEPA No Action Alternative. Both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative would achieve over 90 percent of maximum WUA with nearly a 20 percent probability, and both alternatives would achieve over 80 percent of maximum WUA with about an 80 percent probability. Changes of 10 percent or more in annual spawning habitat availability would not occur (Appendix F4, 6 vs. 5, pg. 875).

Water temperatures below the Thermalito Afterbay Outlet during September, which represents the earliest month of the spawning period, would be nearly identical between the NEPA Yuba Accord Alternative and the NEPA No Action Alternative, and commonly exceed water temperatures reported to be suitable for Chinook salmon spawning. For example, under both alternatives, water temperatures below the Thermalito Afterbay Outlet during September exceed 62°F with about a 90 percent probability. Water temperatures under both alternatives would be identical during October, November and December. Under both alternatives, during October water temperatures exceed the reported optimum (56°F) for Chinook salmon spawning with about a 95 percent probability, whereas water temperatures always remain at or below 56°F in November and December (Appendix F4, 6 vs. 5, pgs. 678 through 689 and 702 through 713).

The embryo incubation life stage for Chinook salmon in the Feather River generally extends from September through February. Timing of fry emergence is primarily dependant on water temperature. As indicated above for the spawning life stage, water temperatures below the Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative would be nearly identical, to those under the NEPA No Action Alternative during the September through December period. During January and February, water temperatures generally do not exceed 53°F, and therefore do not approach the lowest water temperature index value (56°F) below the Thermalito Afterbay Outlet under either the NEPA Yuba Accord Alternative or the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs. 678 through 689 and 702 through 713).

Long-term average early life stage survival estimates would be identical under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative (97.6 percent). Early life stage survival estimates do not differ by more than 0.6 percent for any individual year included in the 71-year period of analysis. Substantial reductions in salmon survival over three or more consecutive years would not be observed between the NEPA Yuba Accord Alternative and the NEPA No Action Alternative. Therefore, the NEPA Yuba Accord Alternative is not anticipated to affect potential future recruitment from a given spawning stock, which may in turn affect the population dynamics of subsequent generations (Appendix F4, 6 vs. 5, pg. 881).

Spring-run Chinook salmon juveniles are commonly reported to rear in their natal streams from 9 to 18 months. Specific habitat-discharge relationships for juvenile Chinook salmon rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to Chinook salmon juveniles. Therefore, for impact assessment purposes, year-round examination of water temperatures is conducted to address potential juvenile spring-run Chinook salmon rearing in the Feather River.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative would be nearly identical to those under the NEPA No Action Alternative over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. From November through April, water temperatures generally remain below 60°F under both alternatives. Water temperatures during May remain at or below 65°F with nearly a 90 percent probability, whereas during June water temperatures exceed 65°F with about a 65 percent probability, nearly always exceed 65°F during July and

August, and exceed 65°F during September with about 35 percent probability. Water temperatures are considered to be particularly stressful to rearing juvenile Chinook salmon during July and August, when water temperatures exceed 70°F with about a 30 percent and 20 percent probability, respectively. Overall, during the year-round juvenile Chinook salmon rearing life stage below the Thermalito Afterbay Outlet, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in 1 increase above the 65°F index value, 4 increases above the 68°F index value, and no changes at the 60°F, 63°F, 70°F, or 75°F index values (Appendix F4, 6 vs. 5, pgs. 678 through 689 and 702 through 713).

Spring-run Chinook salmon smolt emigration reportedly occurs from October through June. Flows below the Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would be essentially equivalent or measurably higher with at least about a 90 percent probability from October through June, with the exceptions of April and June. During April below the Thermalito Afterbay Outlet, measurable flow decreases primarily would occur at intermediate to high flow levels under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. These flow reductions at the intermediate to high flow levels would not be expected to substantively affect spring-run Chinook salmon smolt emigration habitat conditions. During June, flow decreases consistently would occur across most of the cumulative flow distributions, but remain above 1,500 cfs with about a 90 percent probability, and above 3,000 cfs with about an 80 percent probability (Appendix F4, 6 vs. 5, pgs. 604 through 615 and 628 through 639).

Simulated flows below the Thermalito Afterbay Outlet do not change by ten percent or more, with more than a 3 percent probability during any month of the smolt emigration life stage, with the exceptions of November, May, and June. Flows under the NEPA Yuba Accord Alternative would be higher by ten percent or more with about a 10 percent probability in November and a 5 percent probability in May. During low flow conditions in May, flows would be higher by ten percent or more with about a 5 percent probability. During June, flows under the NEPA Yuba Accord Alternative would be lower by ten percent or more with about a 20 percent probability overall, and with about a 65 percent probability during low flow conditions (Appendix F4, 6 vs. 5, pgs. 604 through 615 and 628 through 639).

During the smolt emigration period, flows at the mouth of the Feather River exhibit generally similar trends to those observed at the Thermalito Afterbay Outlet location with the notable exceptions of: (1) additional measurable flow increases during October, particularly during relatively low flow conditions; (2) additional measurable flow increases during November, particularly during low flow conditions and additional measurable flow decreases during high flow conditions; (3) measurable flow reductions at intermediate and high flow levels during December; (4) measurable flow reductions during intermediate to low flow conditions in January and measurable flow increases at the driest conditions; (5) additional flow decreases during February and March resulting in measurably lower flows for about 30 and 20 percent of the distribution, respectively; and (6) measurable flow decreases at intermediate to low flow conditions during May, although flows would remain at or above 2,000 cfs about 95 percent of the time (Appendix F4, 6 vs. 5, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative would be generally equivalent over the entire cumulative water temperature distributions during the October through June smolt emigration life stage period. Under both alternatives, water temperatures always remain below the 60°F index value from November through March, remain below the 60°F index value with about a 50 and 90 percent probability during October and April, respectively, with only about a 10 percent probability during May, and always exceed the 60°F index value during June (Appendix F4, 6 vs. 5, pgs. 678 through 689 and 702 through 713).

With the exception of the winter months of November through February when water temperatures remain cool (< 56°F), water temperatures at the mouth of the Feather River would be warmer than at Thermalito Afterbay Outlet during the October through June smolt emigration life stage. At the mouth of the Feather River, water temperatures under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would be generally equivalent during October, March, and April. During intermediate to warm water temperature conditions, water temperatures would be measurably warmer during May, which generally occur during "drier" water year types. During June, water temperatures under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would be essentially equivalent for about 94 percent of the cumulative flow distribution, would be measurably cooler for 1 percent, and would be measurably warmer for the remaining 5 percent (Appendix F4, 6 vs. 5, pgs. 825 through 836 and 849 through 860).

Overall, during the entire October through June smolt emigration period below the Thermalito Afterbay Outlet, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in 4 increases above the 68°F index value and no changes at the 60°F, 63°F, or 70°F index values (Appendix F4, 6 vs. 5, pgs. 678 through 689). At the mouth of the Feather River, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, results in 1 decrease below the 60°F index value, 1 increase above the 63°F index value, 2 decreases below the 70°F index value, and no changes at the 60°F or 68°F index values (Appendix F4, 6 vs. 5, pgs. 825 through 836).

The most notable trends in flow and water temperature conditions during the smolt emigration period are: (1) flow reductions primarily occurring at intermediate to low flow conditions during May and June; and (2) measurably warmer water temperatures during May. This trend may not substantively affect spring-run Chinook salmon smolt emigration because: (1) as discussed above under the lower Yuba River spring-run Chinook salmon smolt emigration discussion, this flow pattern may accommodate the emigration of juvenile spring-run Chinook salmon before warm water temperatures occur during late spring in drier water years in the lower portion of the Feather River; and (2) in the Feather River, data on juvenile Chinook salmon emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run emigration (DWR and Reclamation 1999; Painter *et al.* 1977).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative is expected to provide:

- Generally equivalent adult immigration and holding conditions, because of: (1) equivalent or measurably higher flows at Thermalito Afterbay Outlet with a probability ranging from 70 percent to 100 percent during all months of this life stage with the exception of April and June; (2) during April at Thermalito Afterbay Outlet, measurable flow decreases at intermediate to high flow levels, and during June flow decreases across most of the cumulative flow distribution, but remaining above 1,500 cfs for about 90 percent of the distribution, and above 3,000 cfs for about 80 percent of distribution; and (3) water temperatures would be consistently about 0.3 to about 1°F cooler at the mouth of the Feather River during July and August, when temperatures are stressful to this species and life stage

- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period, and nearly identical water temperatures below the Thermalito Afterbay Outlet
- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates
- Equivalent over-summer juvenile rearing conditions due to nearly identical water temperatures below the Thermalito Afterbay Outlet
- Generally equivalent smolt emigration conditions due to generally equivalent flow and water temperature conditions with the exception of flow reductions primarily occurring at intermediate to low flow conditions during May and June, and measurably warmer water temperatures during May at the mouth of the Feather River. This trend may not substantively affect spring-run Chinook salmon smolt emigration because: (1) as discussed above under the lower Yuba River spring-run Chinook salmon smolt emigration discussion, this flow pattern may accommodate the emigration of juvenile spring-run Chinook salmon before warm water temperatures occur during late spring in drier water years in the lower portion of the Feather River; and (2) in the Feather River, data on juvenile Chinook salmon emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run emigration (DWR and Reclamation 1999; Painter *et al.* 1977).

In conclusion, in consideration of potential effects to all life stages of spring-run Chinook salmon, the NEPA Yuba Accord Alternative would be expected to result in less than significant impact to spring-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.8-12: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The analytical period for adult immigration and holding of fall-run Chinook salmon in the Feather River extends from July through December. The flows under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative during March through October are described in the discussion provided above for spring-run Chinook salmon adult immigration and holding. That discussion concludes that the flows under the NEPA Yuba Accord Alternative provide generally equivalent adult immigration and holding conditions for spring-run Chinook salmon, relative to the NEPA No Action Alternative flows. During November and December, the only months during the fall-run Chinook salmon adult immigration and holding life stage period that do not overlap with the spring-run Chinook salmon adult immigration and holding period, flows at Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative would be essentially equivalent to or higher than the flows under the NEPA No Action Alternative for nearly the entire cumulative flow distribution during November and for about 90 percent of the distribution in December (Appendix F4, 6 vs. 5, pgs. 628 through 639). At the mouth of the Feather River, flows under the NEPA Yuba Accord Alternative would be essentially equivalent or higher than flows under the NEPA No Action Alternative for about 85 percent of the cumulative flow distribution during November and for about 50 percent in December; flows would be lower in December at intermediate to high flows (e.g., when flows would be greater than about 3,000 cfs). Therefore, flows under the NEPA Yuba Accord Alternative would be expected to provide generally equivalent adult immigration and holding conditions for fall-run Chinook salmon, relative to the NEPA No Action Alternative flows (Appendix F4, 6 vs. 5, pgs. 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative would be essentially equivalent over nearly the entire cumulative water temperature distributions during the July through December adult immigration and holding life stage period. Under both alternatives, water temperatures nearly always exceed the 60°F index value from July through September, remain below the 60°F index value with about a 50 percent probability during October, and always remain at or below the 60°F index value during November and December. Under both alternatives, water temperatures exceed the 68°F water temperature index value with about a 55, 50, and 3 percent probability during July, August, and September, respectively (Appendix F4, 6 vs. 5, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River would be generally warmer than at Thermalito Afterbay Outlet during each month of the July through December adult immigration and holding life stage, particularly during the warm summer months of July through September, when water temperatures at the mouth of the Feather River would be frequently 1 – 4°F warmer than at the Thermalito Afterbay Outlet, under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative. At the mouth of the Feather River, during July and August, water temperatures under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative always exceed the 68°F water temperature index value, although water temperatures under the NEPA Yuba Accord Alternative would be consistently about 0.3 to about 1.5°F cooler than the NEPA No Action Alternative, when temperatures are stressful to this species and life stage. Water temperatures at the mouth of the Feather River under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would be nearly always essentially equivalent from September through December (Appendix F4, 6 vs. 5, pgs. 825 through 836 and 849 through 860).

Overall, during the entire July through December adult immigration and holding period below the Thermalito Afterbay Outlet and at the mouth of the Feather River, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in 1 decrease below the 60°F index value, 1 decrease below the 64°F index value, and no changes at the 68°F index value (Appendix G, 6 vs. 5, pgs. G-277 through G-278).

The adult spawning and embryo incubation life stage periodicities of fall-run Chinook salmon in the Feather River are not distinguished from those of the spring-run; therefore these life stages are not evaluated separately. For evaluation of Chinook salmon spawning and embryo incubation under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, see the discussion provided above under spring-run Chinook salmon.

The analytical period for fall-run Chinook salmon juvenile rearing and outmigration on the Feather River extends from November through June. The flows under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative during October through June are described in detail in the discussion provided above for spring-run Chinook salmon smolt emigration. That discussion suggests that the relative flow differences between the operational alternatives during the October through June period would not be expected to substantially affect spring-run Chinook salmon smolt emigration. Therefore, because the fall-run Chinook salmon juvenile outmigration period (November through June) falls within the spring-run Chinook salmon smolt emigration period (October through June), the flow differences from fall through spring also would not be expected to have substantial effects on fall-run Chinook salmon juvenile outmigration.

Specific habitat-discharge relationships for juvenile Chinook salmon rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, water temperatures may be a primary stressor to rearing Chinook salmon juveniles. Therefore, for impact assessment purposes, an examination of water temperatures during November through June is conducted to address potential impacts to juvenile fall-run Chinook salmon rearing in the Feather River. This examination also applies to juveniles migrating downstream because, the thermal requirements of fall-run Chinook salmon juveniles would be equivalent whether the juveniles are rearing or migrating downstream.

Simulated water temperatures under both alternatives would be generally similar for each month of the fall-run Chinook salmon juvenile rearing life stage. From November through April, water temperatures at the Thermalito Afterbay Outlet generally remain below 60°F under both alternatives. Water temperatures during May remain at or below 65°F with nearly a 90 percent probability, whereas during June water temperatures exceed 65°F with about a 65 percent probability. The NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative results in 1 increase above the 65°F index value, 4 increases above the 68°F index value, and no changes at the 60°F, 63°F, 70°F, or 75°F index values (Appendix F4, 6 vs. 5, pgs. 678 through 689 and 702 through 713).

Simulated water temperatures at the mouth of the Feather River under both alternatives would be essentially equivalent for at least about 95 percent of the cumulative water temperature distribution from November through April, and in June. During May, water temperatures under the NEPA Yuba Accord Alternative would be measurably warmer than under the NEPA No Action Alternative, particularly during intermediate to warm conditions. Under both alternatives in May, water temperatures would be below 70°F for about 90 percent of the cumulative water temperature distribution. Water temperatures are considered to be particularly stressful to rearing juvenile Chinook salmon during June, when water temperatures exceed 70°F with about a 55 percent probability under both alternatives (Appendix F4, 6 vs. 5, pgs. 849 through 860). Overall, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative results in 1 increase above the 63°F index value and no changes at the 60°F, 65°F, 68°F, 70°F or 75°F index values (Appendix F4, 6 vs. 5, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative is expected to provide:

- Generally equivalent or improved adult immigration and holding conditions, because of: (1) generally similar flows at Thermalito Afterbay Outlet and at the mouth of the Feather River during most months of this life stage (July through December); and (2) water temperatures would be consistently about 0.3 to about 1°F cooler at the mouth of the Feather River during July and August, when temperatures are stressful to this species and life stage

- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period, and nearly identical water temperatures below the Thermalito Afterbay Outlet

- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates

- Equivalent rearing and outmigration conditions due to: (1) essentially equivalent flows at Thermalito Afterbay Outlet and at the mouth of the Feather River for most months during November through June, which provides similar juvenile rearing and outmigration conditions; and (2) essentially equivalent water temperatures for juvenile rearing and outmigration below the Thermalito Afterbay Outlet and at the mouth of the Feather River for most months from November through June, with measurably warmer water temperatures during May about 40 percent of the time at the mouth of the Feather River

In conclusion, in consideration of potential effects to all life stages of fall-run Chinook salmon, the NEPA Yuba Accord Alternative would be expected to result in less than significant impact to fall-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.8-13: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the Feather River extends from August through April. Simulated flows below the Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would be essentially equivalent or measurably higher ranging from about a 70 percent to 98 percent probability all months of this life stage, except for April, when flows would be measurably lower with about a 30 percent probability. Flows would be also primarily generally equivalent during low flow conditions, with flow differences of ten percent or more only occurring in September and February with about a 10 percent and 5 percent probability, respectively (Appendix F4, 6 vs. 5, pgs. 604 through 615 and 628 through 639).

At the mouth of the Feather River, simulated flows under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would be essentially equivalent or measurably higher with a probability ranging from about 70 percent to 100 percent during August through April, except for December and January. During these exceptions, flows would be measurably lower with a probability ranging from about 50 percent to 80 percent probability; however, the flow reductions primarily would occur when flows would be greater than 2,000 cfs and therefore would not be expected to substantially affect steelhead adult immigration and holding. During low flow conditions from August through April, flows at the mouth of the Feather River under the NEPA Yuba Accord Alternative would be higher by ten percent or more than the flows under the NEPA No Action Alternative with about a 90 percent probability in August and about a 10 percent probability in October, December, January, and February; flows would be lower by ten percent or more with about a 25 percent probability in January and about a 5 percent probability in March (Appendix F4, 6 vs. 5, pgs. 776 through 787 and 800 through 811).

In general, the NEPA Yuba Accord Alternative is expected to provide an equivalent or somewhat cooler and therefore more suitable thermal regime for steelhead adult immigration and holding, relative to the NEPA No Action Alternative. For example, water temperatures at Thermalito Afterbay Outlet and at the mouth of the Feather River under both alternatives would be essentially equivalent for at least 96 percent of the cumulative water temperature distribution for each month from August through April. The only exception to this is during August at the mouth of the Feather when water temperatures would be measurably cooler under the NEPA Yuba Accord Alternative with about a 96 percent probability, relative to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs. 702 through 713 and 800 through 811). Overall, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative results in no changes at either the 52°F or 56°F index values and 7 decreases below the 70°F index value (Appendix G, 6 vs. 5, pg. G-278).

The steelhead spawning season in the Feather River generally extends from December through March. During this life stage, the long-term average annual spawning habitat availability under both alternatives was 57.8 percent of maximum WUA. Both alternatives provided over 90 percent of the maximum WUA for about 12 percent of the cumulative WUA distribution. The spawning habitat availability under the NEPA Yuba Accord Alternative never differed from that under the NEPA No Action Alternative by ten percent or more (Appendix F4, 6 vs. 5, pgs. 876 and 878).

From December through March, water temperatures at Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative would be almost always essentially equivalent to water temperatures under the NEPA No Action Alternative. During the adult spawning life stage, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in no changes at any of the steelhead spawning index values (Appendix F4, 6 vs. 5, pgs. 678 through 689).

The embryo incubation period for steelhead in the Feather River generally overlaps with the spawning period, but extends into May. During April and May, water temperatures at Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative would be essentially equivalent to the water temperatures under the NEPA No Action Alternative. Overall, during the embryo incubation life stage at the Thermalito Afterbay Outlet, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in 1 decrease below the 54°F index value and no changes at the 52°F, 57°F, or 60°F index values (Appendix F4, 6 vs. 5, pgs. 702 through 713).

Steelhead juveniles are believed to rear in the Feather River year-round. Specific habitat-discharge relationships for juvenile rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative would be nearly identical to those under the NEPA No Action Alternative over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. From November through April, water temperatures generally remain below 60°F under both alternatives. Water temperatures during May remain at or below 65°F with nearly a 90 percent probability, whereas during June water temperatures exceed 65°F with about a 65 percent probability, always exceed 65°F during July and August, and exceed 65°F with about a 35 percent and 1 percent probability during September and October, respectively. Water temperatures are considered to be particularly stressful to rearing steelhead during July and August, when water temperatures exceed 70°F with about a 30 percent and 20 percent probability, respectively. Overall, during the year-round steelhead rearing life stage below the Thermalito Afterbay Outlet, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in 1 increase above the 65°F index value, 4 increases above the 68°F index value, and no changes at the 72°F or 75°F index values (appendix F4, 6 vs. 5, pgs. 702 through 713).

The Feather River steelhead smolt emigration analytical period is believed to extend from October through May. The flows under the NEPA Yuba Accord Alternative, relative to the

NEPA No Action Alternative during October through June are described in detail in the discussion provided above for spring-run Chinook salmon smolt emigration. That discussion suggests that the relative flow differences between the operational alternatives during the October through June period would not be expected to substantially affect spring-run Chinook salmon smolt emigration; therefore, because the steelhead smolt emigration period (October through May) falls within the spring-run Chinook salmon smolt emigration period (October through June), the flow differences from fall through spring also would not be expected to have substantial effects on steelhead smolt emigration.

Simulated water temperatures below the Thermalito Afterbay Outlet under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative would be generally equivalent over the entire cumulative water temperature distributions during the October through May smolt emigration life stage period. With the exception of the winter months of November through February when water temperatures remain cool (< 56°F), water temperatures at the mouth of the Feather River would be warmer than at Thermalito Afterbay Outlet during the October through May smolt emigration life stage. At the mouth of the Feather River, water temperatures under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would be generally equivalent during October, March, and April. During intermediate to warm water temperature conditions, water temperatures would be measurably warmer (by up to 0.8°F) under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative during May, which generally occur during "drier" water year types (Appendix F4, 6 vs. 5, pgs. 678 through 689, 702 through 713, 825 through 836, and 849 through 860).

Overall, during the entire October through May smolt emigration period below the Thermalito Afterbay Outlet, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in no changes at the 52°F, 55°F, and 59°F index values (Appendix F4, 6 vs. 5, pgs. 678 through 689). At the mouth of the Feather River, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, results in no changes at the 52°F index value, 1 increase above the 55°F index value, and 1 increase above the 59°F index value (Appendix F4, 6 vs. 5, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding conditions due to: (1) essentially equivalent or slightly higher flows throughout this life stage; (2) similar holding habitat conditions; and (3) measurably cooler water temperatures during August at the mouth of the Feather River, when water temperatures would be stressful (> 68°F)
- Equivalent spawning habitat availability, and essentially equivalent water temperatures at Thermalito Afterbay Outlet during the December through March adult spawning period
- Essentially equivalent water temperatures at Thermalito Afterbay Outlet over nearly the entire embryo incubation period
- Essentially equivalent water temperatures at Thermalito Afterbay Outlet over nearly the entire year-round juvenile rearing period

- Generally equivalent smolt emigration conditions due to: similar flows during the majority of the smolt emigration period (October through May) at Thermalito Afterbay Outlet; higher flows during low to intermediate flow conditions during October, November and December at the mouth of the Feather River; lower flows under low to intermediate flow conditions at the mouth of the Feather River during May; and measurably warmer water temperatures about 40 percent of the time during May at the mouth of the Feather River

In conclusion, in consideration of potential effects to all life stages of steelhead, the NEPA Yuba Accord Alternative is expected to result in less than significant impact to steelhead, relative to the NEPA No Action Alternative.

Impact 10.2.8-14: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect green sturgeon

The analytical period for green sturgeon adult immigration and holding extends from February through July. Simulated flows below the Thermalito Afterbay Outlet would be essentially equivalent or measurably higher ranging from about a 90 percent to 98 percent probability all months of this life stage with the exception of April and June. During April, measurable flow decreases would occur at intermediate to high flow levels. During June, flow decreases consistently occur across most of the cumulative flow distribution, but remain above about 1,500 cfs about 90 percent of the distribution, and above 3,000 cfs for about 80 percent of the distribution. Simulated flows below the Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative, relative to under the NEPA No Action Alternative would be higher by ten percent or more during this life stage with a 1 percent probability in February, a 5 percent probability during May, a 1 percent probability during June, and about a 10 percent probability in July; flows would be lower by ten percent or more for 3 percent during April and for about 20 percent during June. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 5 percent probability during February, May, and June, and with about a 45 percent probability during July. By contrast, during relatively low flow conditions flows would be never lower by ten percent or more during this life stage except for the month of June when flows would be lower by ten percent or more with about a 65 percent probability (Appendix F4, 6 vs. 5, pgs. 628 through 639 and 702 through 713).

This temporal trend in flow changes also occurs at Shanghai Bench and at the mouth of the Feather River, with the exception that flows during May would be generally lower at intermediate to low flow conditions and flows during June would be lower at primarily low flow conditions under the NEPA Yuba Accord Alternative than under the NEPA No Action Alternative. For example, during low flow conditions at Shanghai Bench, flows would be lower by ten percent or more with about a 90 percent probability during May, and about a 50 percent probability during June; conversely flows would be higher by ten percent or more with about a 70 percent probability during July. Based on the frequency and magnitude of the flow changes observed in the monthly mean flow data, as well as in the data for long-term average flows, average flows by water year type, and flow exceedance, flows during the green sturgeon immigration and holding life stage would be expected to provide similar conditions for upstream migration and holding under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs. 751 through 762 and 800 through 811).

Because the analytical period for green sturgeon spawning (i.e., March through July) falls within the adult immigration and holding analytical period, flows under the NEPA Yuba

Accord Alternative, relative to the NEPA No Action Alternative also would be expected to provide similar conditions for the spawning life stage.

Relative to the NEPA No Action Alternative, water temperatures under the NEPA Yuba Accord Alternative would be expected to provide similar conditions during each of the adult immigration and holding, spawning, and embryo incubation life stages. From February through July at Thermalito Afterbay Outlet, water temperatures under both alternatives would be essentially equivalent with a 100 percent probability, except for June and July which have essentially equivalent water temperatures with about a 90 percent and 95 percent probability, respectively. At the mouth of the Feather River, water temperatures under both alternatives also would be essentially equivalent with a probability of at least 95 percent, except for during May when water temperatures would be measurably warmer at primarily intermediate to warm conditions for about 40 percent of the cumulative water temperature distribution and during July when water temperatures would be measurably cooler for about 90 percent of the distribution (Appendix F4, 6 vs. 5, pgs. 849 through 860). During the adult immigration and holding life stage at the Thermalito Afterbay Outlet and at the mouth of the Feather River, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, results in 2 increases above the 61°F index value. During the adult spawning and embryo incubation life stages, which are evaluated at the Thermalito Afterbay Outlet, but not at the mouth of the Feather River, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, results 4 increases above the 68°F index value (Appendix F4, 6 vs. 5, pgs. 678 through 689 and 825 through 836).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Specific habitat-discharge relationships for green sturgeon juvenile rearing have not been developed for the Feather River. Year-round flows below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River have been generally described above under the spring-run Chinook salmon, fall-run Chinook salmon, and steelhead life stage evaluations. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juveniles.

Relative to the NEPA No Action Alternative, water temperatures under the NEPA Yuba Accord Alternative would be expected to provide similar conditions during the juvenile rearing life stage. Simulated water temperature conditions below the Thermalito Afterbay Outlet under the NEPA Yuba Accord Alternative would be nearly identical to those under the NEPA No Action Alternative over the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. For example, the water temperatures under the alternatives would be essentially equivalent for at least about 90 percent of the cumulative water temperature distribution during any given month (Appendix F4, 6 vs. 5, pgs. 702 through 713). Simulated water temperatures at the mouth of the Feather River under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would be generally similar from September through April, would be slightly warmer during May and June, and would be cooler during July and August. Overall, during the year-round juvenile green sturgeon rearing life stage below the Thermalito Afterbay Outlet and at the mouth of the Feather River, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative results in 6 increases above the 66°F index value (Appendix F4, 6 vs. 5, pgs. 849 through 860).

The analytical period for the juvenile emigration life stage extends from May through September. Trends in flows during this life stage are encompassed in the description above for spring-run Chinook salmon adult immigration and holding. Also, similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juvenile emigration. As described in the discussion for juvenile rearing, the NEPA Yuba Accord Alternative is expected to provide generally similar water temperature conditions year-round.

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative would be expected to provide:

- Generally equivalent adult immigration and holding, adult spawning and embryo incubation conditions, because of corresponding upstream migration and spawning flow-related habitat availabilities, and suitable water temperatures during adult immigration and holding
- Generally equivalent over-summer rearing and juvenile emigration conditions, due to generally equivalent water temperatures

In conclusion, in consideration of potential effects to all life stages of green sturgeon, the NEPA Yuba Accord Alternative is expected to result in less than significant impact to green sturgeon, relative to the NEPA No Action Alternative.

Impact 10.2.8-15: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect American Shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Feather River. As discussed above for lower Yuba River American shad, shifting of proportional flows (lower Feather River flows/Sacramento River flows) may simply re-allocate shad from the Sacramento River to the lower Feather River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for American shad attraction into the lower Feather River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Feather River flow, measured at its mouth, to Sacramento River flow, measured downstream of its confluence with the Feather River, is 0.1 percent lower during April, 0.4 percent lower during May, and 0.4 percent lower during June under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. Under the NEPA Yuba Accord Alternative, during wet and above normal years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.1 percent higher during May, with no change in April and June. During below normal years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 1.1 percent lower during April and May, with no change during June. During dry years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 1.0 percent lower during April, 2.3 percent lower during May, and 1.0 percent lower during June. During critical years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.2 percent higher during

April, 1.4 percent lower during May, and 3.7 percent lower during June (Appendix F4, 6 vs. 5, pgs. 775 and 882).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. The lower proportionate flows, particularly in April and May of below normal years, and in May and June of dry and critical years, would not be expected to significantly affect American shad attraction into the lower Feather River because the combined probability of occurrence of dry and critical years is less than one-third of the time, and because proportionate flows would be fairly similar or slightly higher in wet and above normal years, in June of below normal years, and April of critical years.

Differences in water temperature between the Sacramento and lower Feather rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in two additional occurrences (out of the 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Feather River mouth (Appendix F4, 6 vs. 5, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative would result in a less than significant impact to lower Feather River American shad.

Impact 10.2.8-16: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Feather River. Striped bass spawning and initial rearing in the lower Feather River extends from April through June. Proportionate flow changes resulting from implementation of the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Feather River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. The lower proportionate flows, particularly in April and May of below normal years, and in May and June of dry and critical years, would not be expected to significantly affect striped bass attraction into, and spawning and initial rearing in the lower Feather River because the combined probability of occurrence of dry and critical years is less than one-third of the time, and because proportionate flows would be fairly similar or slightly higher in wet and above normal years, and in June of below normal years.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in no changes in the number of occurrences when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at mouth of the Feather River (Appendix F4, 6 vs. 5, pgs. 825 and 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative would result in a less than significant impact to lower Feather River striped bass.

Impact 10.2.8-17: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail spawning, embryo incubation, and initial rearing life stages in the lower Feather River occur from February through May. Over the entire 72-year period of simulated February through May estimates of usable flooded area (UFA), long-term average UFA in the lower Feather River is 0.2 percent lower under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, with average estimates of UFA by water year type ranging from 0.2 percent higher during wet years to 1.2 percent lower during below normal years. Changes of 10 percent or more in UFA do not occur over more than 10 percent of the cumulative UFA distributions (Appendix F4, 6 vs. 5, pgs. 879 through 880).

Over the entire 71-year simulation period, February through May monthly mean water temperatures below the Thermalito Afterbay Outlet, under both the NEPA Yuba Accord Alternative and NEPA No Action Alternative remain within the 45 - 75°F range of water temperatures reported to be suitable for splittail spawning (Appendix F4, 6 vs. 5, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative would result in a less than significant impact to Sacramento splittail in the lower Feather River.

SACRAMENTO RIVER BASIN

Sacramento River

The following sections describe and discuss flow and water temperature differences between the NEPA Yuba Accord Alternative and the NEPA No Action Alternative, and potential effects on fisheries and aquatic resources in the Sacramento River immediately downstream of the Feather River confluence and at Freeport.

Model output demonstrates relatively minor, but measurable changes in flows in the Sacramento River downstream of the Feather River confluence. For example, over the 864 months simulated for the Sacramento River immediately below the Feather River confluence, only two monthly mean flows indicate that a 10 percent or greater change under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative – a decrease of 15.5 percent (8,132 versus 9,627 cfs) and 10.8 percent (12,066 versus 13,522 cfs), both during June. The cumulative flow distributions for the NEPA Yuba Accord Alternative and the NEPA No Action Alternative, below the Feather River confluence demonstrate: generally equivalent flows during February, March and April; slight flow decreases (generally < 3 percent) primarily at intermediate flow levels during December and January; slight flow decreases (generally < 5 percent) primarily at intermediate to low flow levels during May and June; slight (< 5 percent) but frequent (about 95 percent of the time) flow increases during July and August; and slight (< 3 percent) flow increases at low to intermediate flow levels during September, October and November. Similar results are evident in the Sacramento River at Freeport, with changes in mean monthly flows of 10 percent or more occurring only once (13.6 percent decrease [9,485 versus 10,980 cfs] during June) under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs. 907 through 918 and 1030 through 1041).

Water temperatures in the Sacramento River immediately downstream of the Feather River confluence generally remain similar under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative during most months. In fact, below the Feather River confluence, only 8 out of the 852 months simulated indicate that measurably warmer (> 0.3°F) water temperatures under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, with no water temperature changes exceeding 0.4°F. By contrast, water temperatures would be measurably cooler (< 0.3°F) under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative in 40 out of the 852 months simulated in the Sacramento River immediately downstream of the Feather River confluence, including 1 decrease in May, 8 decreases during July, and 31 decreases during August, with water temperature differences not exceeding 0.8°F. At Freeport, water temperatures would be generally similar between the NEPA Yuba Accord Alternative and the NEPA No Action Alternative. In fact, only 6 (all during August) out of the 852 months simulated at Freeport would result in measurably cooler (< 0.3°F) water temperatures under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, with water temperature differences not exceeding 0.5°F. Immediately downstream of the Feather River confluence, the cumulative water temperatures distributions for the NEPA Yuba Accord Alternative and the NEPA No Action Alternative demonstrate essentially equivalent water temperatures during all months of the year with the exception of August, when water temperatures would be measurably but slightly (generally < 0.5°F) cooler 30 percent of the time (Appendix F4, 6 vs. 5, pgs. 957 through 968). At Freeport, water temperatures would be essentially equivalent during all months of the year (Appendix F4, 6 vs. 5, pgs. 1055 through 1066).

Impact 10.2.8-18: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect winter-run Chinook salmon

The winter-run Chinook salmon adult immigration and holding life stage occurs in the Sacramento River from December through July. The flow and water temperature differences between the NEPA Yuba Accord Alternative and the NEPA No Action Alternative, described above, would not be expected to substantially affect the Sacramento River winter-run Chinook salmon adult immigration and holding life stage due to:

- Only relatively minor and infrequent changes in flows and water temperatures would occur at the lower Feather River confluence and at Freeport; and
- Overall, for the 568 months included in the analysis, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any of the water temperature index values for this life stage, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 6 vs. 5, pgs. 883 through 894 and 1006 through 1017).

The juvenile rearing and outmigration life stage extends from June through April. The relatively minor and infrequent changes in flows and water temperatures that would occur at the lower Feather River confluence and at Freeport (described above) would not be expected to affect juvenile rearing and outmigration. Overall, for the 781 months included in the analysis, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below, any of the juvenile rearing and outmigration water temperature index values both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 6 vs. 5, pgs. 883 through 894, 957 through 968, 1006 through 1017, 1055 through 1066, and Appendix G, 6 vs. 5, pg. G-286).

In conclusion, in consideration of potential effects to all relevant life stages of winter-run Chinook salmon, the NEPA Yuba Accord Alternative would result in a less than significant impact to winter-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.8-19: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

Spring-run Chinook salmon adult immigration and holding extends from February through September. As discussed above, only relatively minor and infrequent changes in flows and water temperatures would occur at the lower Feather River confluence and at Freeport, which would not be expected to substantively affect adult immigration and holding. Overall, both immediately downstream of the Feather River confluence and at Freeport, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any of the water temperature index values for this life stage (Appendix F4, 6 vs. 5, pgs. 883 through 894, 957 through 968, 1006 through 1017, 1055 through 1066, and Appendix G, 6 vs. 5, pg. G-288).

Juvenile rearing occurs year-round in the lower Feather River. Overall, for the 852 months included in the analysis, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any of the juvenile rearing water temperature index values, both immediately downstream of the Feather River confluence and at Freeport. Smolt emigration occurs from October through June. Overall, for the 639 months included in the analysis, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any of the smolt emigration index values, both immediately downstream of the Feather River confluence and at Freeport. Based on the flow and water temperature modeling results described above, the relatively minor changes that would occur in flows and water temperatures would not be expected to substantially affect spring-run Chinook salmon juvenile rearing and smolt emigration (Appendix F4, 6 vs. 5, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of spring-run Chinook salmon, the NEPA Yuba Accord Alternative would result in a less than significant impact to spring-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.8-20: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

Fall-run Chinook salmon adult immigration and holding extends from July through December, and juvenile rearing and outmigration extends from December through June. Overall, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any of the adult immigration and holding, and juvenile rearing and outmigration water temperature index values, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 6 vs. 5, pgs. 957 through 968 and 1055 through 1066).

Based on the flow and water temperature modeling results described above, the relatively minor changes that would occur in flows and water temperatures would not be expected to substantially affect adult immigration and holding, or juvenile rearing and outmigration, under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative.

In conclusion, in consideration of potential effects to all relevant life stages of fall-run Chinook salmon, the NEPA Yuba Accord Alternative would result in a less than significant impact to fall-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.8-21: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect late fall-run Chinook salmon

Late fall-run Chinook salmon adult immigration and holding extends from October through April, and juvenile rearing and outmigration extends from April through December. Overall, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any of the adult immigration and holding, and juvenile rearing and outmigration water temperature index values, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 6 vs. 5, pgs. 957 through 968 and 1055 through 1066).

Based on the flow and water temperature modeling results described above, the relatively minor changes that would occur in flows and water temperatures would not be expected to substantially affect late fall-run Chinook salmon adult immigration and holding, or juvenile rearing and outmigration.

In conclusion, in consideration of potential effects to all relevant life stages of late fall-run Chinook salmon, the NEPA Yuba Accord Alternative would result in a less than significant impact relative to the NEPA No Action Alternative.

Impact 10.2.8-22: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect steelhead

In the Sacramento River, the steelhead adult immigration and holding life stage period extends from August through March. Overall, for the 568 months included in the analysis, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any of steelhead adult immigration and holding water temperature index values, both immediately downstream of the Feather River confluence and at Freeport. The steelhead juvenile rearing life stage occurs year-round, and the smolt emigration life stage extends from October through May. During the steelhead juvenile rearing period, for the 852 months included in the analysis immediately downstream of the Feather River confluence, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative results in 3 decreases below the 72°F index value, and 1 decrease below the 75°F water temperature index value (Appendix F4, 6 vs. 5, pgs. 957 through 968 and 1055 through 1066).

The relatively minor and infrequent changes in flows and water temperatures that would occur at the lower Feather River confluence and at Freeport (described above) would not be expected to affect steelhead adult immigration and holding, juvenile rearing, or smolt emigration.

In conclusion, in consideration of potential effects to all relevant life stages of steelhead, the NEPA Yuba Accord Alternative would result in a less than significant impact to steelhead, relative to the NEPA No Action Alternative.

Impact 10.2.8-23: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect green sturgeon

Green sturgeon adult immigration and holding extends from February through July, adult spawning and embryo incubation extend from March through July, juvenile rearing occurs year-round, and juvenile emigration occurs May through September. Overall, no changes occur across any water temperature index value for any green sturgeon life stage in the Sacramento River, both immediately downstream of the Feather River confluence and at Freeport. Based on the flow and water temperature modeling results described above, the minor changes that would occur in flows and water temperatures would not be expected to substantially affect these green sturgeon life stages (Appendix F4, 6 vs. 5, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of green sturgeon, the NEPA Yuba Accord Alternative would result in a less than significant impact to green sturgeon, relative to the NEPA No Action Alternative.

Impact 10.2.8-24: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect American shad

American shad adult immigration and spawning extends from April through June. Based on the flow and water temperature modeling results, the minor changes that would occur in flows and water temperatures would not be expected to substantially affect American shad adult immigration and spawning. Additionally, for the 213 months included in the analysis, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative would result no increase above or decrease below any of the American shad adult immigration and spawning index values, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 6 vs. 5, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the NEPA Yuba Accord Alternative would result in a less than significant impact to American shad, relative to the NEPA No Action Alternative.

Impact 10.2.8-25: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect striped bass

Striped bass adult spawning, embryo incubation and initial rearing extend from April through June. The relatively minor and infrequent changes in flows and water temperatures that would occur at the lower Feather River confluence and at Freeport (described above) would not be expected to affect striped bass adult spawning, embryo incubation and initial rearing. Additionally, for the 213 months included in the analysis, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below the 59°F and 68°F index values, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 6 vs. 5, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the NEPA Yuba Accord Alternative would result in a less than significant impact to striped bass, relative to the NEPA No Action Alternative.

Impact 10.2.8-26: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail adult spawning, embryo incubation and initial rearing extend from February through May. Over the 72-year simulation period, the frequency with which the Yolo Bypass floodplains would be inundated with Sacramento River water would be the same under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative. In the Sacramento River immediately downstream of the lower Feather River confluence, for the 288 months included in the analysis, the NEPA Yuba Accord Alternative would provide 1 fewer month with monthly mean flows greater than 56,000 cfs. These results suggest that the availability of splittail spawning, egg incubation, and initial rearing habitat would be essentially the same under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs. 883 through 894).

Over the 72-year simulation period, the February through May monthly mean water temperatures on the Sacramento River immediately downstream of the lower Feather River confluence under both the NEPA Yuba Accord Alternative and the NEPA No Action Alternative would always be within the suitable range (i.e., 45°F to 75°F) for splittail spawning (Appendix F4, 6 vs. 5, pgs. 957 through 968).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative would result in a less than significant impact to Sacramento splittail.

10.2.8.3 DELTA REGION

The evaluation of biological impacts on delta fisheries resources and their habitats use parameters established by the USFWS, CDFG, NMFS and others, including X2 locations, Delta outflows and E/I ratios, presented below.

X2 LOCATION

Over the entire 72-year period of simulated X2 locations, long-term average X2 locations under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would range from 0.2 km higher during June (70.6 versus 70.4 km) to 0.2 km lower during September (84.4 versus 84.6 km). Under the NEPA Yuba Accord Alternative, average X2 location by water year type would range from: 0.1 km higher during January (68.5 versus 68.4 km) and February (60.9 versus 60.8 km) to 0.3 km lower during September (83.3 versus 83.6 km) in wet years; 0.1 km higher during January (79.2 versus 79.1 km) and February (68.9 versus 68.8 km) to 0.2 km lower during September (83.4 versus 83.6 km) in above normal years; 0.2 km higher during February (75.2 versus 75.0 km) and June (71.1 versus 71.5 km) to 0.3 km lower during September (85.6 versus 85.9 km) in below normal years; 0.4 km higher during February (80.1 versus 79.7 km) to 0.1 km lower during October (87.4 versus 87.5 km), November (86.7 versus 86.8 km), and September (85.0 versus 85.1 km)in dry years; and 0.2 km higher during June (82.0 versus 81.8 km) and July (83.2 versus 83.0 km) to 0.1 km lower during October (87.5 versus 87.6 km), November (87.1 versus 87.2 km), December (84.7 versus 84.8 km), January (84.5 versus 84.6 km) and February (81.7 versus 81.8 km) in critical years (Appendix F4, 6 vs. 5, pg. 1189).

Cumulative X2 location distributions for the NEPA Yuba Accord Alternative and the NEPA No Action Alternative would generally overlap during each month of the year, indicating that the X2 location under each scenario would be downstream of compliance points in the Delta with nearly equal probabilities. Although rare, monthly mean X2 location would occasionally change by 1.0 km or more, including the following occasions: (1) three upstream movements (1.0 km, 1.0 km, and 1.2 km) during January. Changes in X2 location of 1.0 km or more result in the upstream movement of X2 past the designated compliance points at the Confluence on 1 occasion (Appendix F4, 6 vs. 5, pgs. 1214 through 1225).

Over the entire 72-year simulation period during the delta smelt spawning season (February through June), the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, would result in a 0.5 km or greater upstream shift while X2 is located between Chipps Island and the Confluence compliance points during 14 out of 360 months included in the analysis. These upstream shifts would occur 10 times during February and 4 time during June (Appendix F4, 6 vs. 5, pgs. 1190 through 1201).

DELTA OUTFLOW

Over the entire 72-year period of simulated Delta outflow, long-term average Delta outflow would range from 2 percent higher during August (4,334 versus 4,245 cfs) to 1 percent lower during December (20,474 versus 20,703 cfs), January (35,138 versus 35,371 cfs), and May (20,218 versus 20,332 cfs) under the NEPA Yuba Accord Alternative, relative to the NEPA No Project Alternative. Under the NEPA Yuba Accord Alternative, average Delta outflow by water year type would range from: 4 percent higher during August (4,177 versus 4,032 cfs) to 1 percent lower during December (46,636 versus 47,150 cfs) in wet years; 2 percent higher during July (7,656 versus 7,515 cfs) and August (4,436 versus 4,366 cfs) to 2 percent lower during November (9,775 versus 9,935 cfs) in above normal years; 3 percent higher during August (3,842 versus 3,741 cfs) to 2 percent lower during January (17,994 versus 18,420 cfs) in below normal years; 1 percent higher during August (4,632 versus 4,576 cfs) and September (3,424 versus 3,380 cfs) to 4 percent lower during January (8,532 versus 8,905 cfs) in dry years; and 1 percent higher during October (4,198 versus 4,159 cfs), December (5,233 versus 5,183 cfs), August (4,730 versus 4,704 cfs), and September (2,928 versus 2,903 cfs) to 3 percent lower during May (5,508 versus 5,670 cfs) in critical years (Appendix F4, 6 vs. 5, pg. 1140).

Over the 72-year period of simulation the NEPA Yuba Accord Alternative, relative to the NEPA No Project Alternative, would result in increases in the percentage of Delta outflows of 5 percent or more in 7 out of 864 months included in the analysis, and decreases of 5 percent or more in 32 out of 864 months (Appendix F4, 6 vs. 5, pgs. 1141 through 1152).

EXPORT-TO-INFLOW RATIO

Delta E/I ratio limits are built into the CALSIM modeling assumptions and, therefore, are consistently met under both the Proposed Action and Environmental Baseline during all months of the year. Nevertheless, over the entire 72-year period of simulated E/I ratios, long-term average E/I ratio would range from 1 percent higher during December, January, May, July, and August to 2 percent lower during June under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pg. 1238). Under the NEPA Yuba Accord Alternative, average E/I ratio by water year type would range from: 1 percent higher during December, July, and August to no change during all other months in wet years; 1 percent higher during December through February to no change during all other months in above normal years; 2 percent higher during May to 1 percent lower during July in below normal years; 2 percent higher during December, January, July, and August to 2 percent lower during June in dry years; and 4 percent higher during August to 17 percent lower during June in critical years. Over the 72-year period of simulation the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would result in a maximum increase of 7 percent, and a maximum decrease of 8 percent in the E/I ratios during any month included in the analysis. Moreover, increases in the percentage of E/I ratios would exceed 5 percent in only 2 out of 864 months included in the analysis.

SALVAGE ESTIMATION

Delta Smelt

The combined overall estimated salvage for delta smelt at the CVP and SWP salvage facilities would decrease by 0.6 percent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (average salvage of 105,400 and 106,045, respectively). The combined estimated salvage by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would change by: (1) 0.1 percent increase during wet (average salvage of 144,432 versus 144,355) and above normal (average salvage of 108,357 versus 108,218) years; (2) 0.2 percent decrease during below normal years (average salvage of 122,696 versus 122,912); (4) 1.0 percent decrease during dry years (average salvage of 96,606 versus 97,586); and (5) 3.9 percent decrease during critical years (average salvage of 54,908 versus 57,151) (Appendix F4, 6 vs. 5, pg. 1336).

Winter-run Chinook Salmon

The combined overall estimated salvage for winter-run Chinook salmon at the CVP and SWP salvage facilities would decrease by 0.1 percent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (average salvage of 13,992 and 14,007, respectively). The combined estimated salvage by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative changes by: (1) no change during wet, above normal, and below normal years; (2) 0.5 percent decrease during dry years (average salvage of 14,478 versus 14,556); and (3) 0.1 percent decrease during critical years (average salvage of 9,563 versus 9,573) (Appendix F4, 6 vs. 5, pg. 1324).

Spring-run Chinook Salmon

The combined overall estimated salvage for spring-run Chinook salmon at the CVP and SWP salvage facilities would decrease by 0.1 percent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (average salvage of 46,747 and 46,803, respectively). The combined estimated salvage by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would change by: (1) no change during wet, above normal, and below normal years; (2) 1.2 percent decrease during dry years (average salvage of 24,345 versus 24,629); and (5) no change during critical years (Appendix F4, 6 vs. 5, pg. 1324).

Steelhead

The combined overall estimated salvage for steelhead at the CVP and SWP salvage facilities would decrease by 0.1 percent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative (average salvage of 3,840 and 3,843, respectively). The combined estimated salvage by water year type under the NEPA Yuba Accord Alternative, relative to the NEPQ No Action Alternative would change by: (1) no change during wet and above normal years; (2) 0.1 percent increase during below normal years (average salvage of 3,236 versus 3,234); (3) 0.5 percent decrease during dry years (average salvage of 2,754 versus 2,769); and (4) no change during critical years (Appendix F4, 6 vs. 5, pg. 1333).

Striped Bass

The combined overall estimated salvage for striped bass at the CVP and SWP salvage facilities would decrease by 0.5 percent under the NEPA Yuba Accord Alternative, relative to the NEPA

No Action Alternative (average salvage of 3,587,756 and 3,604,029, respectively). The combined estimated salvage by water year type under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would change by: (1) 1.3 percent increase during wet years (average salvage of 4,969,792 versus 4,905,851); (2) 0.7 percent increase during above normal years (average salvage of 4,532,204 versus 4,499,165); (3) 0.2 percent decrease during below normal years (average salvage of 3,994,347 versus 4,003,243); (4) 1.1 percent decrease during dry years (average salvage of 3,004,920 versus 3,038,491); and (5) 8.6 percent decrease during critical years (average salvage of 1,437,516 versus 1,573,392) (Appendix F4, 6 vs. 5, pgs. 1334 through 1335).

Impact 10.2.8-27: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect delta smelt

Model results indicate 14 (out of 360) months during which X2 would shift upstream by 0.5 km or more, while X2 is located between Chipps Island and the Confluence compliance points in response to implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, as described above. These upstream shifts would occur 10 times during February and 4 times during June.

Relative to the NEPA No Action Alternative, the NEPA Yuba Accord Alternative would result in increases in the percentage of Delta outflows of 5 percent or more in 7 out of 864 months included in the analysis, and decreases of 5 percent or more in 32 out of 864 months. Changes in the E/I ratio would be relatively infrequent and of minor magnitude under the NEPA Yuba Accord Alternative, relative to the NEPA No Action. Overall delta smelt estimated salvage at the CVP and SWP facilities would decrease by 0.6 percent, with decreases in salvage of 1.0 percent during dry years, and 3.9 percent during critical years under the NEPA Yuba Accord Alternative, relative to the NEPA No Action.

Delta habitat evaluation parameters (X2 location and Delta outflow) would exhibit an overall slight decreased suitability for delta smelt, although they would not be expected to substantially affect delta smelt habitat. Moreover, an overall decrease in salvage, with decreases during dry and critical years, would be expected to occur. Therefore, based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated delta smelt salvage, the NEPA Yuba Accord Alternative, relative to NEPA No Action, would result in a less than significant impact to delta smelt (Appendix F4, 6 vs. 5, pgs. 1140, 1189, and 1238).

Impact 10.2.8-28: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect winter-run Chinook salmon

The changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, would not be expected to substantially affect winter-run Chinook salmon habitat. In addition, overall estimated winter-run Chinook salmon salvage at the CVP and SWP facilities would decrease by 0.1 percent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated winter-run Chinook salmon salvage, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, would result in a less than significant impact to winter-run Chinook salmon (Appendix F4, 6 vs. 5, pgs. 1140, 1189, and 1238).

Impact 10.2.8-29: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect spring-run Chinook salmon

The changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, would not be expected to substantially affect spring-run Chinook salmon habitat. In addition, overall estimated spring-run Chinook salmon salvage at the CVP and SWP facilities would decrease by 0.1 percent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated spring-run Chinook salmon salvage, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, would result in a less than significant impact to spring-run Chinook salmon (Appendix F4, 6 vs. 5, pgs. 1140, 1189, and 1238).

Impact 10.2.8-30: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect steelhead

The changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, would not be expected to substantially affect steelhead habitat. In addition, overall estimated steelhead salvage at the CVP and SWP facilities would decrease by 0.1 percent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated steelhead salvage, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, would result in a less than significant impact to steelhead (Appendix F4, 6 vs. 5, pgs. 1140, 1189, and 1238).

Impact 10.2.8-31: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect striped bass

The changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, would not be expected to substantially affect striped bass habitat. In addition, overall estimated striped bass salvage at the CVP and SWP facilities would decrease by 0.5 percent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative.

In conclusion, in consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated striped bass salvage, the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, would result in a less than significant impact to striped bass (Appendix F4, 6 vs. 5, pgs. 1140, 1189, and 1238).

Impact 10.2.8-32: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) could affect other Delta fisheries resources

The changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, as described above under the NEPA Yuba Accord Alternative relative to the NEPA No Action Alternative, would not be expected to substantially affect other Delta fisheries resources habitats. In conclusion, the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would result in a less than significant impact to Delta fisheries resources (Appendix F4, 6 vs. 5, pgs. 1140, 1189, and 1238).

10.2.8.4 EXPORT SERVICE AREA

SAN LUIS RESERVOIR

Impact 10.2.8-33: Decreases in San Luis Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Decreases in San Luis Reservoir water surface elevation by more than 6 feet per month would occur the same number of times from March through June under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, over the long-term average and average by water year type. Therefore, changes in reservoir water surface elevation that could occur under the NEPA Yuba Accord Alternative would result in a less than significant impact on San Luis Reservoir warmwater fisheries, relative to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs. 1438 through 1449).

Impact 10.2.8-34: Decreases in San Luis Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Long-term average end of month storage volumes under the NEPA Yuba Accord Alternative would not change from April through November relative to the NEPA No Action Alternative. Average end of month storage volumes also would not change from April through November during wet, above normal, and below normal water year types. During dry and critical water year types, end of month storage volumes would be up to 1 percent lower during most months, and up to 2 percent lower during August and September in dry water years. These relatively minor and infrequent changes in end-of-month reservoir storage that could occur under the NEPA Yuba Accord Alternative would result in a less than significant impact on San Luis Reservoir coldwater fisheries, relative to the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs. 1339 and 1376).

10.2.9 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE NEPA MODIFIED FLOW ALTERNATIVE COMPARED TO THE NEPA NO ACTION ALTERNATIVE

10.2.9.1 YUBA REGION

NEW BULLARDS BAR RESERVOIR

Impact 10.2.9-1: Decreases in New Bullards Bar Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June, with the majority of warmwater fish spawning occurring during the months of April and May. Decreases in the water surface elevation of New Bullards Bar Reservoir by more than 6 feet per month from March through June occur approximately 13 times less often under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 75 through 86). Reduction in the frequency of potential nest dewatering events is expected to result in increased nest success and contribute to self-sustaining warmwater fish populations, although not of sufficient frequency to affect the populations. Therefore, changes in water surface elevations that could occur under the NEPA Modified Flow Alternative would result in a less than significant impact on New Bullards Bar Reservoir warmwater fisheries, relative to the NEPA No Action Alternative.

Impact 10.2.9-2: Decreases in New Bullards Bar Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

The NEPA Modified Flow Alternative results in long-term average New Bullards Bar Reservoir storage of approximately 817 TAF in April to 569 TAF in November (Appendix F4, 7 vs. 5, pg. 1). This reduction corresponds to a change in water surface elevation from approximately 1,922 feet msl to 1,857 feet msl. Under the NEPA No Action Alternative, the November long-term average storage in New Bullards Bar Reservoir is approximately 599 TAF with a corresponding elevation of 1,865 feet msl (Appendix F4, 7 vs. 5, pg.50).

Anticipated reductions in reservoir storage associated with the NEPA Modified Flow Alternative would not be expected to adversely impact the New Bullards Bar Reservoir's coldwater fisheries because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample coldwater pool reserves, and throughout the period of operations of New Bullards Bar Reservoir (1969 through present), which encompasses the most extreme critically dry year on record, the coldwater pool in New Bullards Bar Reservoir has not been depleted. Therefore, potential reductions in coldwater pool storage would not be expected to adversely affect New Bullards Bar Reservoir's coldwater fisheries because: (1) coldwater habitat would remain available in the reservoir during all months of the NEPA Modified Flow Alternative; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fish. Therefore, changes in end-of-month storage that could occur under the NEPA Modified Flow Alternative would result in a less than significant impact on New Bullards Bar Reservoir coldwater fisheries, relative to the NEPA No Action Alternative.

Lower Yuba River

The following sections describe and discuss flow and water temperature differences between the NEPA Modified Flow Alternative and the NEPA No Action Alternative, and potential effects on fisheries and aquatic resources in the lower Yuba River.

Impact 10.2.9-3: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The adult immigration and holding life stage primarily extends from March through October. Evaluation of flows at Marysville occurring under the NEPA Modified Flow Alternative and the NEPA No Action Alternative indicates that both alternatives provide adequate flows for adult spring-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam (Appendix F4, 7 vs. 5, pg. 272). Also, under the NEPA Modified Flow Alternative and the NEPA No Action Alternative, flows in the lower Yuba River throughout the upstream migration period generally remain within the range sufficient to allow adequate passage of adult spring-run Chinook salmon through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville result in the same number of occurrences (4 out of 576 months included in the analysis) during which flows at the Daguerre Point Dam fish ladders exceed 10,000 cfs under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 273 through 284). Finally, under the NEPA

Modified Flow Alternative and the NEPA No Action Alternative, stages at Smartville throughout the adult holding period remain similar. Overall, examination of monthly mean stage simulated at Smartville results in 5 increases of one foot or more (out of 576 months included in the analysis) under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 162 through 173). These relatively infrequent and minor changes in stage would not affect adult spring-run Chinook salmon holding habitat conditions, particularly due to the deep nature of the pools in the Narrows Reach below Englebright Dam.

During the March through October adult immigration and holding life stage, water temperatures at Smartville, under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative, generally remain at or below 58°F, which is below the lowest water temperature index value (60°F), and therefore remain suitable, for this life stage (Appendix F4, 7 vs. 5, pg. 174).

Simulated water temperatures at Daguerre Point Dam under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative generally do not exceed 60°F over the entire cumulative water temperature distributions from March through July, and during October. During August, water temperatures remain below 60°F with about a 90 percent probability under both alternatives. However, during September under the NEPA Modified Flow Alternative and the NEPA No Action Alternative, water temperatures exceed 60°F with about a 40 percent probability. During September under relatively warm water temperature conditions, water temperatures would be measurably higher, and therefore less suitable, about 50 percent of the time. Overall, during the entire March through October adult immigration and holding period at Daguerre Point Dam, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 2 increases above the 60°F index value, no changes at the 64°F and 68°F index values (Appendix G, 7 vs. 5, pgs. G-302 through G-304).

In addition, while the presence of spring-run Chinook salmon below Daguerre Point Dam during the immigration and holding life stage is believed to be transitory, water temperatures during March and April under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, remain below 60°F over the entire cumulative water temperature distributions at Marysville. Measurably warmer water temperatures frequently occur during relatively warm water temperature conditions during May and June. During July through September, water temperatures would be frequently and substantially lower over most of the cumulative water temperature distributions, with measurably warmer water temperatures during the relatively infrequent but warmest water temperature conditions. During October, water temperatures remain below 60°F under both alternatives with about a 25 percent probability, and would be essentially equivalent at water temperatures exceeding 60°F. Overall, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 28 decreases below the 60°F index value, 2 decreases below the 64°F index value, and 7 increases above the 68°F index value at Marysville (Appendix F4, 7 vs. 5, pgs. 371 through 382).

Spring-run Chinook salmon spawning reportedly occurs above Daguerre Point Dam from September through November. During these months, the annual spawning habitat availability under the NEPA Modified Flow Alternative is slightly lower than under the NEPA No Action Alternative (long-term average of 86.3 percent versus 88.5 percent of the maximum WUA) (Appendix F4, 7 vs. 5, pg. 395). The NEPA Modified Flow Alternative achieves over 90 percent of maximum WUA with about a 56 percent probability, while the NEPA No Action Alternative achieves over 90 percent of maximum WUA with about a 64 percent probability. Overall, changes of 10 percent or more in spawning habitat availability do not occur over more than 10 percent of the cumulative WUA distributions (Appendix F4, 7 vs. 5, pg. 399).

The spring-run Chinook salmon spawning habitat analysis also emphasized the month of September, because this is the only month during the spring-run Chinook salmon spawning period that is assumed to not temporally overlap with fall-run Chinook salmon spawning (CDFG 2000). For September, spawning habitat availability, expressed as percent maximum WUA, under the NEPA Modified Flow Alternative is somewhat lower than under the NEPA No Action Alternative (long-term average of 84.0 percent versus 89.7 percent of maximum WUA) (Appendix F4, 7 vs. 5, pg. 395). Overall, for the month of September, the NEPA Modified Flow Alternative achieves over 90 percent of maximum WUA with about a 44 percent probability, while the NEPA No Action Alternative achieves over 90 percent of maximum WUA with about a 64 percent probability. Overall, decreases of 10 percent or more in spawning habitat availability occur over about 23.9 percent (17 out of 71 years) of the September cumulative WUA distributions (Appendix F4, 7 vs. 5, pg. 397).

Water temperatures at Smartville during the September through November spawning period generally do not exceed 56°F, and therefore remain suitable for this life stage (Appendix F4, 7 vs. 5, pgs. 175 through 186). Simulated water temperatures at Daguerre Point Dam during November do not exceed 56°F (Appendix F4, 7 vs. 5, pgs. 224 through 235). During September, simulated water temperatures at Daguerre Point Dam under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative exceed 56°F over nearly the entire cumulative water temperature distributions. However, water temperatures under the NEPA Modified Flow Alternative would be essentially equivalent to the NEPA No Action Alternative about 20 percent of the time, would be measurably lower nearly 70 percent of the time, and would be measurably higher about 10 percent of the time. The measurably higher water temperatures occur during relatively warm water temperature conditions. During October, simulated water temperatures at Daguerre Point Dam under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative exceed 56°F with about a 90 percent probability. However, during October, simulated water temperatures at Daguerre Point Dam under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would be essentially equivalent over about 55 percent, and would be measurably lower, and therefore more suitable, over about 45 percent of the cumulative water temperature distributions (Appendix F4, 7 vs. 5, pgs. 248 through 259). Overall, during the entire September through November spawning period, at Daguerre Point Dam the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 5 decreases below the 56°F index value, 10 decreases below the 58°F index value, 1 decrease below the 60°F index value, and 1 decrease below the 62°F index value (Appendix G, 7 vs. 5, pgs. G-302 through G-304).

The embryo incubation life stage for spring-run Chinook salmon in the lower Yuba River generally occurs between September and March. In addition to the trends described above for the spawning life stage, from December through March, water temperatures generally do not exceed 53°F, do not approach the lowest water temperature index value (56°F), and therefore remain suitable at Daguerre Point Dam under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative (appendix F4, 7 vs. 5, pgs. 248 through 259).

Spring-run Chinook salmon juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to spring-run Chinook salmon juveniles (Appendix F4, 7 vs. 5, pgs. 199 through 210).

Simulated water temperatures at Smartville generally remain below the lowest water temperature index value (60°F), and therefore remain suitable for this life stage year-round, under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 175 through 186).

At Daguerre Point Dam, water temperatures remain below 60°F, and therefore suitable for juvenile rearing, from October through July. During August at Daguerre Point Dam, water temperatures remain below 60°F with about a 90 percent probability under both alternatives. During September under the NEPA Modified Flow Alternative and the NEPA No Action Alternative, water temperatures would be measurably higher, and therefore less suitable under relatively warm water temperature conditions (Appendix F4, 7 vs. 5, pgs. 248 through 259).

At Marysville, water temperatures generally remain below the lowest water temperature index value (60°F), and therefore remain suitable for this life stage from November through April, under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative. Measurably warmer water temperatures frequently occur during relatively warm water temperature conditions during May and June. During July through September, water temperatures would be frequently and substantially lower over most of the cumulative water temperature distributions, with measurably warmer water temperatures during the less frequent but warmest water temperature conditions. During October, water temperatures remain below 60°F under both alternatives with about a 25 percent probability, and would be essentially equivalent at water temperatures exceeding 60°F (Appendix F4, 7 vs. 5, pgs. 371 through 382).

Overall, during the year-round juvenile rearing life stage at Daguerre Point Dam, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 2 increases above the 60°F index value, 1 decrease below the 63°F index value, 1 increase above the 65°F index value, and no change at the 68°F, 70°F or 75°F index values. Overall, at Marysville, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 28 decreases below the 60°F index value, 8 decreases below the 63°F index value, 9 increases above the 65°F index value, 7 increases above the 68°F index value, 4 increases above the 70°F index value, and 1 increase above the 75°F index value (Appendix G, 7 vs. 5, pgs. G-302 through G-304).

The spring-run Chinook salmon smolt emigration period is believed to extend from November through June, although based on CDFG's run-specific determinations, the vast majority (about 94 percent) of spring-run Chinook salmon were captured as post-emergent fry during November and December, with a relatively small percentage (nearly 6 percent) of individuals remaining in the lower Yuba River and captured as YOY from January through March. Only 0.6 percent of the juvenile Chinook salmon identified as spring-run was captured during April, 0.1 percent during May, and none were captured during June. In general, flows during the early portion (November and December) of the smolt emigration period under the NEPA Modified Flow Alternative would be measurably lower at relatively high flow conditions, but would be measurably higher than flows under the NEPA No Action Alternative from low to intermediate flow conditions. Flow reductions at high flow levels would not be expected to substantively affect spring-run Chinook salmon smolt emigration habitat conditions, whereas the measurably higher flows during low and intermediate flow conditions may facilitate smolt emigration. In general, from January through March, measurable flow decreases occur at intermediate flow levels, and flows would be generally equivalent at low flow levels under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. During April, May and June, under relatively low to intermediate flow conditions, measurable and substantial decreases occur. In fact, under low flow conditions, decreases of ten percent or more occur with 100 percent probability for each of the months of April, May and June at both Smartville and at Marysville (Appendix F4, 7 vs. 5, pgs. 125 through 136 and 297 through 308).

During the November through June smolt emigration life stage, water temperatures at Smartville and Daguerre Point Dam under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative remain below 60°F, and therefore remain suitable for this life stage (Appendix G, 7 vs. 5, pgs. G-302 through G-304). Overall, during the entire November through June smolt emigration period at Daguerre Point Dam, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 6 increases above the 60°F index value, and no changes at the 63°F, 68°F and 70°F index values (Appendix F4, 7 vs. 5, pgs. 175 through 186, 199 through 210, 224 through 235, and 248 through 259).

Simulated water temperature conditions at Marysville during the spring-run Chinook salmon smolt emigration period remain below the lowest water temperature index value of 60°F, and therefore remain suitable, from November through April under the NEPA Modified Flow Alternative. Measurably warmer water temperatures frequently occur during relatively warm water temperature conditions during May and June (Appendix F4, 7 vs. 5, pgs. 347 through 358 and 371 through 382). Overall at Marysville, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, results in 12 increases above the 60°F index value, 11 increases above the 63°F index value, 1 increase above the 68°F index value, and no changes at the 70°F index value (Appendix G, 7 vs. 5, pgs. G-302 through G-304).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative is expected to provide:

- Generally equivalent or less suitable adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) similar holding habitat conditions above Daguerre Point Dam; (4) measurably higher, and therefore less suitable water temperatures under relatively warm water temperature conditions (generally ≥ 61°F) during September at Daguerre Point Dam; and (5) higher, and therefore less suitable, water temperatures (2°F to nearly 5°F) during May and June at Marysville during the warmest 25 percent of simulated water temperature conditions

- Less suitable spawning conditions due to: (1) slightly lower spawning habitat availability during the entire September through November adult spawning period; (2) lower spawning habitat availability during September separately as a temporally distinct month; (3) decreases of 10 percent or more in spawning habitat availability over about 23.9 percent (17 out of 71 years) of the September cumulative WUA distributions; and (4) generally equivalent overall water temperature conditions during the spawning period

- Generally equivalent embryo incubation conditions due to measurably lower water temperatures nearly 70 percent of the time when water temperatures are thermally stressful (≥ 56°F), but measurably higher water temperatures (from about 0.5 to 2.5°F) during about 15 percent of the warmest (≥ 61°F), and therefore most stressful, water temperature conditions during September at Daguerre Point Dam

- Generally equivalent or less suitable over-summer juvenile rearing conditions, due to: (1) measurably higher (from about 0.5 to 2.5°F), and therefore less suitable water temperatures for about 15 percent of the warmest (≥ 61°F) water temperature conditions during September at Daguerre Point Dam; (2) higher (2°F to nearly 5°F), and therefore less suitable, water temperatures during May and June at Marysville during the warmest 25 percent of simulated water temperature conditions; and (3) frequently and substantially cooler, and therefore more suitable, water temperatures from July through September when water temperatures may be thermally stressful (≥ 60°F), but measurably warmer water temperatures during the relatively infrequent but warmest (≥ 65°F) water temperature conditions at Marysville
- Generally equivalent or less suitable smolt emigration conditions due to: (1) lower flows at intermediate to high flow levels from November through January, and generally similar flows during February and March; (2) during April, May and June under low flow conditions (lowest 25 percent of the flows), decreases of ten percent or more would almost always occur at both Smartville and at Marysville, although few (less than 1 percent) spring-run Chinook salmon juveniles have been captured during this portion of the emigration season

In conclusion, in particular consideration of: measurably higher water temperatures at Daguerre Point Dam during September under relatively warm water temperature conditions (generally ≥ 61°F), and increased water temperatures (2°F to nearly 5°F) during May and June at Marysville under the warmest 25 percent of simulated water temperature conditions during the adult immigration and holding life stage; lower spawning habitat availability overall, and particularly during September separately as a temporally distinct month; and lower flows at intermediate to high flow levels from November through January, and decreases of ten percent or more during April, May and June under low flow conditions (lowest 25 percent of the flows) at both Smartville and at Marysville during the smolt emigration life stage, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would result in a potentially significant impact to lower Yuba River spring-run Chinook salmon.

Impact 10.2.9-4: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The adult immigration and holding life stage for fall-run Chinook salmon in the lower Yuba River primarily extends from August through November. Evaluation of flows at Marysville occurring under the NEPA Modified Flow Alternative and the NEPA No Action Alternative indicate that both alternatives provided adequate flows for adult fall-run Chinook salmon upstream critical riffle passage below Daguerre Point Dam. Also, under the NEPA Modified Flow Alternative and the NEPA No Action Alternative, flows in the lower Yuba River throughout the upstream migration period remain within the range sufficient to allow adequate passage of adult fall-run Chinook salmon through the Daguerre Point Dam fish ladders. During August at Marysville, flows would be substantially higher (> 10 percent) nearly 80 percent of the time, with measurable flow decreases occurring during lowest flow conditions. During September, measurable flow increases occur at intermediate to high flow levels, but measurable flow decreases consistently occur under relatively low flow conditions. During October at Marysville, essentially equivalent flows occur about 20 percent of the time, whereas measurable flow increases occur nearly 80 percent of the time. Flows during the November under the NEPA Modified Flow Alternative would be measurably lower at relatively high flow conditions, but would be measurably higher than flows under the NEPA No Action Alternative from low to intermediate flow conditions. Similar flow patterns are observed at Smartville (Appendix F4, 7 vs. 5, pgs. 297 through 308).

During the August through November adult immigration and holding life stage, water temperatures at Smartville, under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative, generally remain below 57°F, which is below the lowest water temperature index value (60°F), and therefore remain suitable, for this life stage (Appendix F4, 7 vs. 5, pgs. 175 through 186).

During the August through November adult immigration and holding life stage, simulated water temperatures at Daguerre Point Dam under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative generally do not exceed 60°F, and therefore remain suitable, over the entire cumulative water temperature distributions during August, October and November. Water temperatures at Daguerre Point Dam during September exceed 60°F with about a 40 percent probability under both alternatives. However, during September under relatively warm water temperature conditions, water temperatures under the NEPA Modified Flow Alternative would be measurably higher, and therefore less suitable, than the NEPA No Action Alternative with about a 50 percent probability. Overall, during the entire August through November adult immigration and holding period at Daguerre Point Dam, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 2 decreases below the 60°F index value, no change at the 64°F or 68°F index values (Appendix F4, 7 vs. 5, pgs. 248 through 259).

Monthly mean water temperatures during August at Marysville during the adult immigration and holding life stage under the NEPA Modified Flow Alternative would be measurably lower about 50 percent of the time, and therefore more suitable, when water temperatures exceed 60°F under the NEPA No Action Alternative. However, measurable water temperature increases occur at the warmest water temperature conditions. During September at Marysville, water temperatures would be frequently and substantially lower over most of the cumulative water temperature distributions, with measurably warmer water temperatures during the less frequent but warmest water temperature conditions. During October, water temperatures remain below 60°F under both alternatives with about a 25 percent probability, and would be essentially equivalent at water temperatures exceeding 60°F. During November, simulated water temperatures at Marysville remain below 60°F, and therefore remain suitable for this life stage. Overall at Marysville, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, results in 33 decreases below the 60°F index value, 6 decreases below the 64°F index value, and 6 increases above the 68°F index value (Appendix F4, 7 vs. 5, pgs. 371 through 382).

Fall-run Chinook salmon spawning occurs in the lower Yuba River from October through December, and may extend into January. During these months, the annual spawning habitat availability under the NEPA Modified Flow Alternative is similar to that under the NEPA No Action Alternative (long-term average of 85.9 percent versus 86.3 percent of the maximum WUA) (Appendix F4, 7 vs. 5, pg. 400). The NEPA Modified Flow Alternative achieves over 90 percent of maximum WUA with a 60 percent probability, while the NEPA No Action Alternative achieves over 90 percent of maximum WUA with a 62 percent probability. Overall, increases of 10 percent or more in spawning habitat availability do not occur over 10 percent of the cumulative WUA distributions (Appendix F4, 7 vs. 5, pg. 402).

Water temperatures at Smartville during the October through December spawning period generally do not exceed 56°F, and therefore remain suitable for this life stage (Appendix F4, 7 vs. 5, pgs. 199 through 210). During October, simulated water temperatures at Daguerre Point Dam under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative exceed 56°F with about a 90 percent probability. However, during October, simulated water temperatures at Daguerre Point Dam under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would be essentially equivalent over about 55 percent, and would be measurably lower, and therefore more suitable, over about 45 percent of the cumulative water temperature distributions. Simulated water temperatures at Daguerre Point Dam during November and December do not exceed 56°F, and therefore remain suitable for this life stage (Appendix F4, 7 vs. 5, pgs. 248 through 259). At Marysville, water temperatures during October exceed 56°F over nearly the entire cumulative water temperature distribution. Water temperatures would be essentially equivalent approximately 45 percent of the time, but would be measurably cooler, and therefore more suitable, about 55 percent of the time. Simulated water temperatures at Marysville during November and December do not exceed 56°F, and therefore remain suitable for this life stage (Appendix F4, 7 vs. 5, pgs. 371 through 382).

Overall, the NEPA Modified Flow Alternative results in 1 decrease below the 56°F index value, and no changes at the 58°F, 60°F or 62°F index values at Smartville. Overall, the NEPA Modified Flow Alternative results in 4 decreases below the 56°F index value, no change at the 58°F index value, 1 decrease below the 60°F index value, and 1 decrease below the 62°F index value at Daguerre Point Dam. Overall, the NEPA Modified Flow Alternative results in 3 decreases below the 56°F index value, 9 decreases below the 58°F index value, 1 decrease below the 60°F index value, and 1 decrease below the 62°F index value at Marysville (Appendix F4, 7 vs. 5, pgs. 199 through 210, 248 through 259, and 371 through 382).

The embryo incubation period for fall-run Chinook salmon extends from October through March. In addition to the trends described above, between January and March, water temperatures do not exceed 54°F, do not approach the lowest water temperature index value (56°F), and therefore remain suitable, at Daguerre Point Dam and Marysville under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 248 through 259 and 371 through 382).

Juvenile fall-run Chinook salmon rear in and emigrate from the lower Yuba River between December and June, although based on CDFG's run-specific determinations, the majority (about 81 percent) of fall-run Chinook salmon are captured moving downstream from December through March, with decreasing numbers captured during April (about 9 percent), May (about 7 percent), and June (about 3 percent). The discussion of flow and water temperature changes provided for spring-run Chinook salmon smolt emigration (see above) encompasses the entire fall-run Chinook salmon juvenile rearing and outmigration time period. As described above, during December and January measurable flow decreases would occur at intermediate flow levels. During winter (February and March), flows under the NEPA Modified Flow Alternative and the NEPA No Action Alternative would be generally similar. During April, May and June, measurable and substantial flow decreases would occur under relatively low to intermediate flow conditions. In fact, under low flow conditions (lowest 25 percent of the flows), decreases of ten percent or more would almost always occur during each of the months of April, May and June at both Smartville and at Marysville (Appendix G, 7 vs. 5, pgs. G-306 through G-307).

As described in Section 10.2.3, under the CEQA Yuba Accord Alternative relative to the CEQA No Project Alternative, a temporal shift (lower flows during approximately the lowest 40 percent of flow conditions in May and June, accompanied by higher flows during about the lowest 35 percent of flow conditions during April) in flows was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes, associated with the timing of juvenile Chinook salmon emigration. This flow pattern was designed to facilitate the emigration of juvenile Chinook salmon when most of them are emigrating, and before warm water temperatures occur during late spring in drier water years in the lower portion of the lower Yuba River, the Feather River, and the Sacramento River.

By contrast to the CEQA Yuba Accord Alternative compared to the CEQA No Project Alternative, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would not provide increased flows under low flow conditions during April, and therefore is not consistent with the intentional design to mimic Yuba River unimpaired springtime flow patterns to facilitate outmigration during drier water years. In addition, by contrast to the discussion of spring-run Chinook salmon smolt emigration (described above), nearly 20 percent of juvenile fall-run Chinook salmon outmigrants have been captured during April, May and June (Appendix G, 7 vs. 5, pgs. G-306 through G-307).

Overall, during the entire December through June juvenile rearing and outmigration period at Daguerre Point Dam, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 6 increases above the 60°F index value, and no changes at the 63°F, 65°F, 68°F and 70°F index values (Appendix F4, 7 vs. 5, pgs. 248 through 259). Overall at Marysville, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, results in 12 increases above the 60°F index value, 11 increases above the 63°F index value, 16 increases above the 65°F index value, 1 increase above the 68°F index value, and no changes at the 70°F or 75°F index values (Appendix F4, 7 vs. 5, pgs. 371 through 382 and Appendix G, 7 vs. 5, pgs. G-306 through G-307).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative is expected to provide:

- Generally equivalent or less suitable adult immigration and holding conditions because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; and (3) suitable water temperatures above Daguerre Point Dam during August, October and November; (4) measurably higher, and therefore less suitable, water temperatures at Daguerre Point Dam during September under relatively warm water temperature conditions (generally ≥ 61°F); and (5) frequently and substantially lower, and therefore more suitable, water temperatures during July, August and September at Marysville, but higher and therefore less suitable water temperatures during the less frequent but warmest water temperature conditions (generally ≥ 67°F) during July, August and September

- Generally equivalent or improved spawning conditions due to similar spawning habitat availability during the October through December adult spawning period, and frequently lower and therefore generally more suitable water temperatures during October at Daguerre Point Dam and at Marysville

- Generally equivalent or improved embryo incubation conditions due to slightly cooler water temperature conditions during October, and similar and suitable water temperatures during November through March of this life stage period

- Less suitable juvenile rearing and outmigration conditions due to: (1) lower flows at intermediate to high flow levels during December and January, and similar flows during February and March; (2) during April, May and June under low flow conditions (lowest 25 percent of the flows), decreases of ten percent or more would almost always occur at both Smartville and at Marysville, which is inconsistent with Yuba River unimpaired springtime flow patterns and the facilitation of outmigration during drier water years, and may affect up to nearly 20 percent of juvenile fall-run Chinook salmon outmigrants; and (3) higher, and therefore less suitable, water temperatures (2°F to nearly 5°F) during May and June at Marysville during the warmest 25 percent of simulated water temperature conditions

In conclusion, in particular consideration of: measurably higher water temperatures at Daguerre Point Dam during September under relatively warm water temperature conditions (generally ≥ 61°F), and higher water temperatures during the warmest water temperature conditions (generally ≥ 67°F) during July, August and September at Marysville during the adult immigration and holding life stage; and reduced flows during the lowest 25 percent of flow conditions during April, May and June, with increased water temperatures during May and June during the juvenile rearing and outmigration life stage, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would result in a potentially significant impact to lower Yuba River fall-run Chinook salmon.

Impact 10.2.9-5: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the lower Yuba River extends from August through March. Evaluation of flows at Marysville occurring under the NEPA Modified Flow Alternative and the NEPA No Action Alternative indicate that both alternatives provide adequate flows for adult steelhead upstream critical riffle passage below Daguerre Point Dam. Also, under the NEPA Modified Flow Alternative and the NEPA No Action Alternative, flows in the lower Yuba River throughout the upstream migration period generally remain within the range sufficient to allow adequate passage of adult steelhead through the Daguerre Point Dam fish ladders. Overall, monthly mean flows simulated at Marysville result in no change in the number of occurrences during which flows at the Daguerre Point Dam fish ladders exceed 10,000 cfs under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (13 out of 576 months included in the analysis) (Appendix F4, 7 vs. 5, pgs. 273 through 284).

During August of the adult immigration and holding life stage, flows at Marysville would be substantially higher (> 10 percent) nearly 80 percent of the time, with measurable flow decreases occurring during lowest flow conditions. During September, measurable flow increases occur at intermediate to high flow levels, but measurable flow decreases consistently occur under relatively low flow conditions. During October at Marysville, essentially equivalent flows occur about 20 percent of the time, whereas measurable flow increases occur nearly 80 percent of the time. Flows during the November under the NEPA Modified Flow Alternative would be measurably lower at relatively high flow conditions, but would be measurably higher than flows under the NEPA No Action Alternative from low to intermediate flow conditions. Similar flow patterns are observed at Smartville (Appendix F4, 7 vs. 5, pgs. 125 through 136 and 297 through 308).

During December flows under the NEPA Modified Flow Alternative would be measurably lower at relatively high flow conditions, but would be measurably higher than flows under the

NEPA No Action Alternative from low to intermediate flow conditions. Flow reductions at high flow levels would not be expected to substantively affect steelhead adult immigration and holding habitat conditions. In general, from January through March, measurable flow decreases occur at intermediate flow levels, and flows would be generally equivalent at low flow levels under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative.

During the August through March adult immigration and holding life stage, water temperatures at Smartville generally remain cool and suitable for this life stage. From August through October, water temperatures exceed the 52°F index value but generally remain below the 56°F index value. From November through March, water temperatures at Smartville generally remain below the 52°F index value (Appendix F4, 7 vs. 5, pgs. 199 through 210).

During the adult immigration and holding life stage, simulated water temperatures during August at Daguerre Point Dam under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative would be essentially equivalent about 25 percent of the time, but would be measurably cooler, and therefore more suitable, about 70 percent of the time. Water temperatures at Daguerre Point Dam during September exceed the 56°F index value nearly 100 percent of the time under both alternatives. However, during September water temperatures would be measurably cooler, and therefore more suitable, about 70 percent of the time, and would be measurably warmer, and therefore less suitable, slightly more than 10 percent of the time. The water temperature increases occur under relatively warm water temperature conditions. During October, water temperatures exceed the 52°F index value but generally remain below the 56°F index value. From November through March, water temperatures generally remain below 52°F, and therefore remain suitable, for this life stage (Appendix F4, 7 vs. 5, pgs. 248 through 259).

At Marysville during August and September of the adult immigration and holding life stage, water temperatures under the NEPA Modified Flow Alternative would be consistently and substantially lower, and therefore more suitable, over 70 to 80 percent of the cumulative water temperature distributions, although measurable water temperature increases occur under the warmest water temperature conditions. During October at Marysville, water temperatures exceed 56°F about 90 percent of the time under both alternatives, would be essentially equivalent about 45 percent of the time, and would be measurably lower, and therefore more suitable, about 55 percent of the time. During November and March, water temperatures remain below 52°F nearly 50 percent of the time, and generally remain below 54°F. Simulated water temperatures at Marysville from December through February do not exceed 52°F, and therefore remain suitable for adult immigration and holding (Appendix F4, 7 vs. 5, pgs. 371 through 382).

Overall, during the adult immigration and holding life stage at Smartville, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 2 decreases below the 52°F index value, 3 decreases below the 56°F index value, and no change at the 70°F index value (Appendix F4, 7 vs. 5, pgs. 199 through 210). At Daguerre Point Dam, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 3 decreases below the 52°F index value, 16 decreases below the 56°F index value, and no change at the 70°F index value (Appendix F4, 7 vs. 5, pgs. 248 through 259). At Marysville, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 6 increases above the 52°F index value, and 4 decreases below the 56°F index value, and 3 increases above the 70°F index value (Appendix F4, 7 vs. 5, pgs. 371 through 382).

The steelhead spawning season generally extends from January through April, primarily occurring in reaches upstream of Daguerre Point Dam. During these months, the annual spawning habitat availability under the NEPA Modified Flow Alternative is slightly higher than under the NEPA No Action Alternative (long-term average of 38.1 percent versus 35.6 percent of the maximum WUA) (Appendix F4, 7 vs. 5, pg. 403). The NEPA Modified Flow Alternative achieves over 50 percent of maximum WUA with about a 35 percent probability, while the NEPA No Action Alternative achieves over 50 percent of maximum WUA with about a 30 percent probability. Overall, increases of 10 percent or more in spawning habitat availability occur over about 11.1 percent (8 out of 72 years) of the cumulative WUA distributions (Appendix F4, 7 vs. 5, pgs. 405).

From January through April, water temperatures at Smartville do not exceed 52°F, which is the lowest water temperature index value for this life stage, and therefore remain suitable for adult spawning (Appendix F4, 7 vs. 5, pgs. 199 through 210). During January and February, water temperatures at Daguerre Point Dam also do not exceed 52°F. During March, water temperatures at Daguerre Point Dam under the NEPA Modified Flow Alternative would be essentially equivalent to water temperatures under the NEPA No Action Alternative, and exceed 52°F with about a 25 percent probability, yet remain below 53°F. During April, water temperatures at Daguerre Point Dam under the NEPA Modified Flow Alternative would be essentially equivalent to the water temperatures under the NEPA No Action Alternative about 85 percent of the cumulative water temperature distributions, and would be measurably higher about 15 percent of the time (which occurs during relatively warm - about 55°F to 56°F - water temperature conditions). Overall, during the adult spawning life stage, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 1 increase above the 54°F index value, and no changes at other index values at Daguerre Point Dam (Appendix F4, 7 vs. 5, pgs. 248 through 259).

The embryo incubation period for steelhead in the lower Yuba River general overlaps with the spawning period, but extends into May. During May, water temperatures at Smartville under the NEPA Modified Flow Alternative and the NEPA No Action Alternative would be essentially equivalent over approximately 85 percent of the cumulative water temperature distributions, and remain below 54°F. Under relatively warm (about 52.5 to 53°F) water temperature conditions, slight but measurable increases in water temperature frequently occur under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 199 through 210). During May, water temperatures at Daguerre Point Dam under the NEPA Modified Flow Alternative would be essentially equivalent to the water temperatures under the NEPA No Action Alternative over approximately 75 percent of the cumulative water temperature distribution, and would be measurably higher with about a 25 percent probability. All of the measurable water temperature increases occur during relatively warm water temperature conditions, when water temperatures range from about 55.5°F to more than 59°F, and therefore may result in less suitable embryo incubation conditions (Appendix F4, 7 vs. 5, pgs. 248 through 259).

Overall, during the embryo incubation life stage at Smartville, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 4 increases above the 52°F index value, and no changes at the 54°F, 57°F, or 60°F index values (Appendix F4, 7 vs. 5, pgs. 175 through 186). At Daguerre Point Dam, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in no changes at the 52°F index value, 1 increase above the 54°F index value, 8 increases above the 57°F index value, and no changes at the 60°F index value (Appendix F4, 7 vs. 5, pgs. 224 through 235).

Steelhead juveniles are believed to rear in the lower Yuba River year-round. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles.

The discussion of general water temperature changes provided for spring-run Chinook salmon year-round juvenile rearing (see above) applies to the steelhead juvenile rearing life stage. The only difference is that the steelhead juvenile rearing life stage includes slightly different water temperature index values. Water temperatures generally remain below 65°F, and therefore remain suitable for steelhead juvenile rearing, throughout the year at Smartville and Daguerre Point Dam (Appendix F4, 7 vs. 5, pgs. 175 through 186 and 224 through 235). At Marysville, water temperatures generally remain below 65°F for all months of the year with the exceptions of June, July, August and September. During June at Marysville, water temperatures remain below 65°F approximately 75 percent of the time under the NEPA Modified Flow Alternative, yet remain below 65°F over nearly the entire cumulative water temperature distribution under the NEPA No Action Alternative. This difference is due to measurably warmer water temperatures consistently occurring under the NEPA Modified Flow Alternative under relatively warm water temperature conditions. Water temperatures at Marysville exceed 65°F about 20 percent of the time under the NEPA Modified Flow Alternative, and nearly 30 percent of the time under the NEPA No Action Alternative during July, and about 20 percent of the time under both alternatives during August. During September, water temperatures exceed 65°F nearly 30 percent of the time under both alternatives. During July, August and September, measurable water temperature increases occur during warmest water temperature conditions under the NEPA Modified Flow Alternative (Appendix F4, 7 vs. 5, pgs. 371 through 382).

Overall, during the year-round juvenile rearing life stage at Daguerre Point Dam, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 1 increase above the 65°F index value, and no change at the 68°F, 72°F or 75°F index values (Appendix F4, 7 vs. 5, pgs. 224 through 235). Overall, at Marysville, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 9 increases above the 65°F index value, 7 increases above the 68°F index value, no change at the 72°F index value, and 1 increase above the 75°F index value (Appendix F4, 7 vs. 5, pgs. 347 through 358).

The steelhead smolt emigration period is believed to extend from October through May. The discussion of flow and water temperature changes provided for spring-run Chinook salmon smolt emigration (see above) encompasses nearly the entire fall-run Chinook salmon juvenile rearing and outmigration time period. The only differences are that the steelhead smolt emigration period encompasses one additional month (October) and one less month (June), and includes different water temperature index values. During October at Smartville and at Marysville, essentially equivalent flows occur about 20 percent of the time, whereas measurable flow increases occur nearly 80 percent of the time (Appendix F4, 7 vs. 5, pgs. 125 through 136 and 297 through 308).

During October of the smolt emigration life stage, water temperatures at Smartville always exceed 52°F, yet remain below 54°F, and would be slightly lower at the warmest water temperature conditions under the NEPA Modified Flow Alternative (Appendix F4, 7 vs. 5, pgs. 199 through 210). During October, water temperatures at Daguerre Point Dam always exceed 52°F, yet remain below 59°F, and would be lower over about 45 percent of the cumulative water temperature distributions (Appendix F4, 7 vs. 5, pgs. 248 through 259). During October, water temperatures at Marysville always exceed 52°F, yet remain below 61°F, and would be lower over about 55 percent of the cumulative water temperature distributions (Appendix F4, 7 vs. 5, pgs. 371 through 382).

Overall, during the smolt emigration life stage at Smartville, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 2 increases above the 52°F index value, 1 decrease below the 55°F index value, and no change at the 59°F index value (Appendix F4, 7 vs. 5, pgs. 199 through 210). Overall at Daguerre Point Dam, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 3 decreases below the 52°F index value, 1 increase above the 55°F index value, and 1 decrease below the 59°F index value (Appendix F4, 7 vs. 5, pgs. 248 through 259). Overall, at Marysville, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 6 increases above the 52°F index value, 2 decreases below the 55°F index value, and 2 decreases below the 59°F index value (Appendix F4, 7 vs. 5, pgs. 371 through 382).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative is expected to provide:

- Generally equivalent adult immigration and holding conditions, because of: (1) equivalent critical riffle passage capabilities below Daguerre Point Dam; (2) the same frequency of flows sufficient to allow passage through the Daguerre Point Dam fish ladders; (3) similar holding habitat conditions; and (4) during August and September, consistently (70 percent of the time) and substantially (1 to nearly 3°F) lower, and therefore more suitable, water temperatures when water temperatures may be thermally stressful (≥ 56°F), but with water temperature increases under the warmest water temperature conditions at Daguerre Point Dam and at Marysville; and (5) frequently lower, and therefore more suitable, water temperatures in the lower portion of the river during October
- Improved spawning conditions due to higher spawning habitat availability, with increases of 10 percent or more in spawning habitat availability occurring 11.1 percent (9 out of 72 years) of the time, and generally overall equivalent water temperature conditions above Daguerre Point Dam during the January through April adult spawning period
- Generally equivalent water temperature conditions over the entire embryo incubation period at Smartville; generally equivalent conditions at Daguerre Point Dam over the majority of the embryo incubation period, with higher water temperatures during April and May under about 25 percent of the warmest water temperature conditions
- Generally equivalent over-summer juvenile rearing conditions, due to: (1) suitable water temperature conditions year-round above Daguerre Point Dam; (2) less frequent suitable water temperatures under about 25 percent of the warmest water temperature conditions during June at Marysville; (3) frequently cooler water temperatures during July and August at Marysville, but with measurable water temperature increases under 3, 5 and 15 percent of the warmest water temperature conditions at Marysville during July, August and September, respectively
- Generally equivalent or less suitable smolt emigration conditions due to: (1) lower flows at intermediate to high flow levels during December and January, and similar flows

during February and March; (2) during April and May under low flow conditions (lowest 25 percent of the flows), decreases of ten percent or more would almost always occur at both Smartville and at Marysville; (3) cool, and therefore suitable, water temperatures at Smartville and Daguerre Point Dam during the entire October through May smolt emigration life stage; (4) cooler and therefore more suitable water temperatures during October at Daguerre Point Dam and at Marysville; and (5) higher, and therefore less suitable, water temperatures during May at Marysville during the warmest 25 percent of simulated water temperature conditions

In conclusion, in consideration of potential impacts to all life stages of steelhead, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would result in a less than significant impact to lower Yuba River steelhead.

Impact 10.2.9-6: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect green sturgeon

Flows during the green sturgeon immigration and holding (February through July) and adult spawning and embryo incubation (March through July) life stage periods would be expected to allow adequate upstream migration and spawning habitat availability, under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Overall, under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, results in 7 decreases below the 61°F index value for adult immigration and holding, 1 increase above the 68°F index value for adult spawning, and 1 increase above the 68°F index value for embryo incubation (Appendix F4, 7 vs. 5, pgs. 199 through 210 and 371 through 382).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Specific habitat-discharge relationships for juvenile rearing have not been developed for the lower Yuba River. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juveniles.

At Marysville, water temperatures generally remain below 66°F for all months of the year over the year-round juvenile rearing period with the exceptions of June, July, August and September. During June at Marysville, water temperatures remain below 66°F approximately 85 percent of the time under the NEPA Modified Flow Alternative, yet remain below 66°F over nearly the entire cumulative water temperature distribution under the NEPA No Action Alternative. This difference is due to measurably warmer water temperatures consistently occurring under the NEPA Modified Flow Alternative under relatively warm water temperature conditions. Water temperatures at Marysville exceed 66°F about 15 percent of the time under the NEPA Modified Flow Alternative, and about 20 percent of the time under the NEPA No Action Alternative during July, and about 10 percent of the time under both alternatives during August. During September, water temperatures exceed 66°F about 25 percent of the time under the NEPA Modified Flow Alternative, and about 15 percent of the time under the NEPA No Action Alternative. During July, August and September, measurable water temperature increases occur during warmest water temperature conditions under the NEPA Modified Flow Alternative. Overall, during the year-round juvenile green sturgeon rearing life stage, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 13 increases above the 66°F index value (Appendix F4, 7 vs. 5, pgs. 347 through 358).

The juvenile emigration life stage generally extends from May through September. Similar to the juvenile rearing life stage, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent the primary stressor to green sturgeon juvenile emigration. As described in the discussion of the year-round juvenile rearing period, the frequency of suitable water temperatures during the juvenile emigration life stage vary among months, but overall results in generally equivalent water temperature conditions. Overall, during the juvenile emigration life stage, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 13 increases above the 66°F index value (Appendix F4, 7 vs. 5, pgs. 199 through 210 and 371 through 382).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative is expected to provide:

- Generally equivalent adult immigration and holding, adult spawning and embryo incubation conditions, because of corresponding upstream migration and spawning flow-related habitat availabilities, and generally equivalent and suitable water temperatures
- Generally equivalent over-summer juvenile rearing and juvenile emigration conditions, due to overall generally equivalent and suitable water temperatures

In conclusion, in consideration of potential impacts to all life stages of green sturgeon, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would result in a less than significant impact to lower Yuba River green sturgeon.

Impact 10.2.9-7: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect American shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Yuba River. Studies conducted on the lower Yuba River suggest that shifting of proportional flows (lower Yuba River flows/lower Feather River flows) may simply re-allocate shad from the Feather River to the lower Yuba River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for American shad attraction into the lower Yuba River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 0.7 percent lower during April, 1.9 percent lower during May, and 0.7 percent lower during June under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Under the NEPA Modified Flow Alternative, during wet years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 0.1 percent higher during April, and no changes occur during May or June. During above normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 0.1 percent lower during April, and no changes occur during May or June. During below normal years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 0.1 percent higher during April, 1.3 percent lower during May, and 0.2 percent lower during June. During dry years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 4.3 percent lower during April, 8.4 percent lower during May, and 2.4 percent lower during June. During critical years the change in long-term average percentage of lower Yuba River flow to lower Feather River flow is 4.7 percent lower during April, 21.2 percent lower during May, and 8.0 percent lower during June (Appendix F4, 7 vs. 5, pgs. 100 and 272).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Long-term average proportionate flows do not differ by more than 2 percent during April, May or June. Also, the lower proportionate flows during dry and critical years would not be expected to significantly affect American shad attraction into the lower Yuba River because the reductions during dry years would be relatively minor and do not exceed about 10 percent, and the combined probability of occurrence of dry and critical years is less than one-third.

Differences in water temperature between the Feather and lower Yuba rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative results in 12 additional occurrences (out of 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Marysville (Appendix F4, 7 vs. 5, pgs. 347 through 358).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative would result in a less than significant impact to lower Yuba River American shad.

Impact 10.2.9-8: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Yuba River flows to lower Feather River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Yuba River. Striped bass spawning and initial rearing in the lower Yuba River extends from April through June. Proportionate flow changes resulting from implementation of the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Yuba River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Long-term average proportionate flows do not differ by more than 2 percent during April, May or June. Also, the lower proportionate flows during dry and critical years would not be expected to significantly affect striped bass attraction into, spawning, embryo incubation and initial rearing in the lower Yuba River because the reductions during dry years would be relatively minor and do not exceed about 10 percent, and the combined probability of occurrence of dry and critical years is less than one-third.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 10 additional occurrences (for the 213 months included in the analysis) when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at Marysville.

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative would result in a less than significant impact to lower Yuba River striped bass.

10.2.9.2 CVP/SWP UPSTREAM OF THE DELTA REGION

FEATHER RIVER BASIN

Oroville Reservoir

Impact 10.2.9-9: Decreases in Oroville Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Reductions in simulated end-of-month water surface elevation in Oroville Reservoir by more than six feet occur the same number of times during March and April, three more times during May, and one less time during June under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative. These changes in water surface elevations would not be anticipated to result in substantial reductions in warmwater fish spawning success, because the results suggest that these potential decreases in water surface elevation would not be expected to occur during more than one month of any spawning season. In addition, a 60 percent nest success rate or greater would be achieved during some months of any annual spawning season, which would be expected to provide sufficient recruitment of individuals into the population over the 72-year simulation period. Therefore, changes in water surface elevations that could occur under the NEPA Modified Flow Alternative would result in a less than significant impact on Oroville Reservoir warmwater fisheries, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 456 through 467).

Impact 10.2.9-10: Decreases in Oroville Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Under the NEPA Modified Flow Alternative, long-term average end of month storage is essentially equivalent from April through November, relative to the NEPA No Action Alternative. Average end of month storage by water year type is essentially equivalent for most months of the April through November period, for all water year types with the exceptions of: a 1 percent decrease during June in dry years; and a 1 percent decrease during May, August, and September in critical years. Therefore, potential changes in coldwater pool storage would not be expected to affect Oroville Reservoir's coldwater fisheries because: (1) coldwater habitat would remain available in the reservoir during all months of the NEPA Modified Flow Alternative; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fish. Therefore, changes in end-of-month storage that could occur under the NEPA Modified Flow Alternative would result in a less than significant impact on Oroville Reservoir coldwater fisheries, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pg. 406).

Lower Feather River

The following sections describe and discuss flow and water temperature differences between the NEPA Modified Flow Alternative and the NEPA No Action Alternative, and potential effects on fisheries and aquatic resources in the lower Feather River.

Over the entire simulation period for every month of the year, long-term average flows and water temperatures for all water year types, monthly mean flows and water temperatures, and the cumulative flow and water temperature distributions in the Low Flow Channel below the Fish Barrier Dam would be essentially equivalent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Therefore, evaluations of potential effects in the lower Feather River are restricted to below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River (Appendix F4, 7 vs. 5, pgs. 505 through 517 and 554 through 566).

Impact 10.2.9-11: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

The analytical period for adult immigration and holding of spring-run Chinook salmon in the Feather River extends from March through October. Simulated flows below the Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would be expected to be essentially equivalent or measurably higher ranging from about a 70 percent to 100 percent probability all months of this life stage. Notable flow decreases would be expected to occur in October at intermediate to high flow conditions and in June at low flow conditions. During June, flows would remain above 1,500 cfs with about a 90 percent probability, and above 3,000 cfs with about an 80 percent probability. Simulated flows below the Thermalito Afterbay Outlet would be higher by ten percent or more with about a 15 percent probability in May and a 1 percent probability in September, and would be lower by ten percent or more for 1 percent during March, April, and July, and for about 5 percent during June. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 10 percent probability during May. By contrast, during relatively low flow conditions, flows would be lower by 10 percent or more with about a 5 percent probability in March and a 15 percent probability during June (Appendix F4, 7 vs. 5, pgs. 604 through 615 and 628 through 639).

Simulated flows at the mouth of the Feather River under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would be expected to be essentially equivalent or measurably higher ranging from about a 70 percent to 97 percent probability all months of this life stage with the exceptions of May and June. During May and June, flow decreases would occur at intermediate to low flow conditions, but remain above 3,000 cfs with about an 80 percent probability during May and with about a 90 percent probability during June. Flows would be expected to be higher by 10 percent or more with about a 3 percent probability in July and about a 30 percent probability in August. By contrast, simulated flows at the mouth of the Feather River would be lower by ten percent or more with about a 3 percent probability during April, a 10 percent probability during May, a 20 percent probability during June, and a 1 percent probability in July and August. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 10 percent probability during July and about a 90 percent probability in August, and would be lower by ten percent or more about 10 percent during April, about 30 percent during May, about 70 percent during June, and about 5 percent during July and August (Appendix F4, 7 vs. 5, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative would be essentially equivalent with at least a 95 percent probability during the March through October adult immigration and holding life stage period. Under both alternatives, water temperatures always remain below the 60°F index value during March, and remain below the 60°F index value with about a 90 percent probability during April, with only about a 10 percent probability during May, and nearly always exceed the 60°F index value from June through September. In fact, water temperatures exceed the 68°F water temperature index value with about a 60 and 50 percent probability during July and August, respectively (Appendix F4, 7 vs. 5, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River would be generally warmer than at Thermalito Afterbay Outlet during each month of the March through October adult immigration and holding life stage, particularly during the warm summer months of June through September, when water temperatures at the mouth of the Feather River would be frequently 1 – 4°F warmer than at the Thermalito Afterbay Outlet, under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative. At the mouth of the Feather River, water temperatures under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would be essentially equivalent with about a 97 percent probability in March and April, with about a 90 percent probability in September, and with about a 95 percent probability in October. During May and June, water temperatures would be measurably warmer at primarily intermediate to warm water temperature conditions. During July and August, water temperatures under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative always exceed the 68°F water temperature index value, although water temperatures under the NEPA Modified Flow Alternative would be consistently about 0.3 to about 1.5°F cooler than the NEPA No Action Alternative, when temperatures are stressful to this species and life stage (Appendix F4, 7 vs. 5, pgs. 825 through 836 and 849 through 860).

Overall, during the entire March through October adult immigration and holding period below the Thermalito Afterbay Outlet, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in no changes at the 60°F, 1 decrease below the 64°F index value, and 2 increases above the 68°F index value (Appendix F4, 7 vs. 5, pgs. 678 through 689). At the mouth of the Feather River, the NEPA Modified Flow Alternative results in 1 decrease below the 60°F index value, no changes at the 64°F index value, and 3 increases above the 68°F index value (Appendix F4, 7 vs. 5, pgs. 825 through 836).

Because no clear distinction between spring- and fall-run Chinook salmon spawning could be derived from survey data collected in the Feather River, the spawning habitat analysis for potential impacts on the two runs was combined into one expanded spawning season (September through December) that was inclusive of all Chinook salmon spawning in the Feather River. Over the 71-year simulation period, the annual spawning habitat availability long-term average for Chinook salmon spawning in the Feather River would be 84.6 percent of the maximum WUA under both alternatives (Appendix F4, 7 vs. 5, pg. 873).

The cumulative annual Chinook salmon spawning habitat availabilities under the NEPA Modified Flow Alternative would be almost undistinguishable from those under the NEPA No Action Alternative. Both the NEPA Modified Flow Alternative and the NEPA No Action Alternative achieve over 90 percent of maximum WUA with nearly a 20 percent probability, and both alternatives achieve over 80 percent of maximum WUA with about an 80 percent probability. Changes of 10 percent or more in annual spawning habitat availability do not occur (Appendix F4, 7 vs. 5, pg. 875).

Water temperatures below the Thermalito Afterbay Outlet during September, which represents the earliest month of the spawning period, would be identical between the NEPA Modified Flow Alternative and the NEPA No Action Alternative, and commonly exceed water temperatures reported to be suitable for Chinook salmon spawning. For example, under both alternatives, water temperatures below the Thermalito Afterbay Outlet during September exceed 62°F with about a 90 percent probability. Water temperatures under both alternatives also would be identical during October, November and December. Under both alternatives, during October water temperatures exceed the reported optimum (56°F) for Chinook salmon spawning with about a 95 percent probability, whereas water temperatures remain suitable for spawning during November and December (Appendix F4, 7 vs. 5, pgs. 678 through 689 and 702 through 713).

The embryo incubation life stage for Chinook salmon in the Feather River generally extends from September through February. Timing of fry emergence is primarily dependant on water temperature. As indicated above for the spawning life stage, water temperatures below the Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative would be identical, to those under the NEPA No Action Alternative during the September through December period. During January and February, water temperatures under both alternatives also would be identical and remain cooler than the lowest water temperature index value (56°F) (Appendix F4, 7 vs. 5, pgs. 678 through 689 and 702 through 713).

Long-term average early life stage survival estimates would be identical under the NEPA Modified Flow Alternative and the NEPA No Action Alternative (97.5 percent). Early life stage survival estimates do not differ by more than 1.2 percent for any individual year included in the 71-year period of analysis. Substantial reductions in salmon survival over three or more consecutive years would not be observed between the NEPA Modified Flow Alternative and the NEPA No Action Alternative. Therefore, the NEPA Modified Flow Alternative is not anticipated to affect potential future recruitment from a given spawning stock, which may in turn affect the population dynamics of subsequent generations (Appendix F4, 7 vs. 5, pg. 881).

Spring-run Chinook salmon juveniles are commonly reported to rear in their natal streams from 9 to 18 months. Specific habitat-discharge relationships for juvenile Chinook salmon rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to Chinook salmon juveniles. Therefore, for impact assessment purposes, year-round examination of water temperatures is conducted to address potential juvenile spring-run Chinook salmon rearing in the Feather River.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative would be essentially equivalent to those under the NEPA No Action Alternative over nearly the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. From November through April, water temperatures generally remain below 60°F under both alternatives. Water temperatures during May remain at or below 65°F with nearly a 90 percent probability, whereas during June water temperatures exceed 65°F with about a 65 percent probability, always exceed 65°F during July and August, and exceed 65°F during September with about a 35 percent probability. Water temperatures would be considered to be particularly stressful to rearing juvenile Chinook salmon during July and August, when water temperatures exceed 70°F with about a 30 percent and 20 percent probability, respectively. Overall, during the year-round juvenile Chinook salmon rearing life stage below the Thermalito Afterbay Outlet, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 1 decrease below the 65°F index value, 2 increases above the 68°F index value, and no changes at the 60°F, 63°F, 70°F, or 75°F index values (Appendix F4, 7 vs. 5, pgs. 678 through 689 and 702 through 713).

Spring-run Chinook salmon smolt emigration reportedly occurs from October through June. Flows below the Thermalito Afterbay Outlet from October through May would be essentially equivalent or measurably higher for at least 90 percent of the cumulative flow distribution during any individual month under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, with the exceptions of October and June. During October, flow decreases would occur at intermediate to high flow conditions under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. During June, measurable flow decreases would occur at intermediate to low flow levels, but would remain above 1,500 cfs with about a 90 percent probability, and above 3,000 cfs with about an 80 percent probability.

Simulated flows below the Thermalito Afterbay Outlet do not change by ten percent or more, with more than a 2 percent probability during any month of the smolt emigration life stage, with the exceptions of November, January, May, and June. Simulated flows below the Thermalito Afterbay Outlet would be higher by ten percent or more with about a 15 percent probability in November and May, and a 3 percent probability in January; flows would be lower by ten percent or more for about 2 percent in November, 1 percent in December, January, March, and April, and about 5 percent in June. During low flow conditions, flows would be higher by ten percent or more during November and May with about a 10 percent probability, and would be lower by ten percent or more during November with about a 10 percent probability, during March with about a 5 percent probability, and during June with about a 15 percent probability (Appendix F4, 7 vs. 5, pgs. 604 through 615 and 628 through 639).

Simulated flows at the mouth of the Feather River would be higher by ten percent or more with a 1 percent probability in December and February, and would be lower by ten percent or more with about a 5 percent probability in November and December, about a 10 percent probability in January and May, a 3 percent probability in April, and about a 20 percent probability in June. During low flow conditions, flows would be never higher by ten percent or more and would be lower by ten percent or more during January, April, May and June with about a 20, 15, 30 and 70 percent probability, respectively (Appendix F4, 7 vs. 5, pgs. 776 through 787 and 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative would be essentially equivalent over nearly the entire cumulative water temperature distributions during the October through June smolt emigration life stage period. Under both alternatives, water temperatures always remain below the 60°F index value from November through March, remain below the 60°F index value with about a 45 and 90 percent probability during October and April, respectively, with only about a 10 percent probability during May, and always exceed the 60°F index value during June (Appendix F4, 7 vs. 5, pgs. 678 through 689 and 702 through 713).

With the exception of the winter months of November through February when water temperatures remain cool (< 56°F), water temperatures at the mouth of the Feather River would be warmer than at Thermalito Afterbay Outlet during the October through June smolt emigration life stage. At the mouth of the Feather River, water temperatures under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would be essentially equivalent during October, March, and April with a probability of at least 95 percent. During primarily intermediate to warm water temperature conditions, water temperatures would be measurably warmer during May, which generally occur during "drier" water year types. During June, water temperatures under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would be essentially equivalent for about 80 percent of the cumulative flow distribution and would be measurably warmer for the remaining 20 percent (Appendix F4, 7 vs. 5, pgs. 825 through 836 and 849 through 860).

Overall, during the entire October through June smolt emigration period below the Thermalito Afterbay Outlet, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in no changes at the 60°F, 63°F, 68°F, or 70°F index values (Appendix F4, 7 vs. 5, pgs. 678 through 689). At the mouth of the Feather River, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, results in 1 decrease below the 60°F index value, 1 increase above the 63°F index value, 3 increases above the 68°F index value, and 2 increases above the 70°F index value (Appendix F4, 7 vs. 5, pgs. 825 through 836).

The most notable trends in flow and water temperature conditions during the smolt emigration period would be: (1) flow reductions primarily occurring at intermediate to low flow conditions during May and June at the mouth of the Feather River; and (2) measurably warmer water temperatures during May and June. This trend may not substantively affect spring-run Chinook salmon smolt emigration because: (1) as discussed above under the lower Yuba River spring-run Chinook salmon smolt emigration discussion, this flow pattern may accommodate the emigration of juvenile spring-run Chinook salmon before warm water temperatures occur during late spring in drier water years in the lower portion of the Feather River; and (2) in the Feather River, data on juvenile Chinook salmon emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run emigration (DWR and Reclamation 1999; Painter *et al.* 1977).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative would be expected to provide:

- Generally equivalent adult immigration and holding conditions due to: (1) equivalent or measurably higher flows ranging from a 70 percent to 100 percent probability during all months of this life stage, with the exceptions of May and June at the mouth of the Feather River; and (2) May and June flows at the mouth of the Feather River would remain above 3,000 cfs with about an 80 percent and a 90 percent probability, respectively
- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period, and nearly identical water temperatures below the Thermalito Afterbay Outlet
- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates
- Equivalent over-summer rearing conditions due to nearly identical water temperatures below the Thermalito Afterbay Outlet
- Generally equivalent smolt emigration conditions due to generally equivalent flow and water temperature conditions with the exception of flow reductions primarily occurring at intermediate to low flow conditions during May and June at the mouth of the Feather River, and measurably warmer water temperatures during May and June. This trend may not substantively affect spring-run Chinook salmon smolt emigration because: (1)

as discussed above under the lower Yuba River spring-run Chinook salmon smolt emigration discussion, this flow pattern may accommodate the emigration of juvenile spring-run Chinook salmon before warm water temperatures occur during late spring in drier water years in the lower portion of the Feather River; and (2) in the Feather River, data on juvenile Chinook salmon emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run emigration (DWR and Reclamation 1999; Painter *et al.* 1977).

In conclusion, in consideration of potential effects to all life stages of spring-run Chinook salmon, the NEPA Modified Flow Alternative would be expected to result in a less than significant impact to spring-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.9-12: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

The analytical period for adult immigration and holding of fall-run Chinook salmon in the Feather River extends from July through December. The flows under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative during March through October are described in the discussion provided above for spring-run Chinook salmon adult immigration and holding. That discussion concludes that the flows under the NEPA Modified Flow Alternative provide generally equivalent adult immigration and holding conditions for spring-run Chinook salmon, relative to the NEPA No Action Alternative flows. During November and December, the only months during the fall-run Chinook salmon adult immigration and holding life stage period that do not overlap with the spring-run Chinook salmon adult immigration and holding period, flows at Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative would be essentially equivalent to or higher than the flows under the NEPA No Action Alternative for 98 percent of the cumulative flow distribution during November and for about 90 percent of the distribution in December (Appendix F4, 7 vs. 5, pgs. 628 through 639). At the mouth of the Feather River, flows under the NEPA Modified Flow Alternative would be essentially equivalent or higher than flows under the NEPA No Action Alternative for about 80 percent of the cumulative flow distribution during November and for about 55 percent in December; flows would be lower in December at intermediate to high flows (e.g., when flows are greater than about 3,000 cfs). Therefore, flows under the NEPA Modified Flow Alternative would be expected to provide generally equivalent adult immigration and holding conditions for fall-run Chinook salmon, relative to the NEPA No Action Alternative flows (Appendix F4, 7 vs. 5, pgs. 800 through 811).

Simulated water temperatures below the Thermalito Afterbay Outlet under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative would be essentially equivalent over nearly the entire cumulative water temperature distributions during the July through December adult immigration and holding life stage period. Under both alternatives, water temperatures nearly always exceed the 60°F index value from July through September, remain below the 60°F index value with about a 50 percent probability during October, and always remain below the 60°F index value during November and December. Under both alternatives, water temperatures exceed the 68°F water temperature index value with about a 60, 50, and 3 percent probability during July, August, and September, respectively (Appendix F4, 7 vs. 5, pgs. 678 through 689 and 702 through 713).

Water temperatures at the mouth of the Feather River would be generally warmer than at Thermalito Afterbay Outlet during each month of the July through December adult immigration and holding life stage, particularly during the warm summer months of July through September, when water temperatures at the mouth of the Feather River would be frequently 1 – 4°F warmer than at the Thermalito Afterbay Outlet, under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative. At the mouth of the Feather River, during July and August, water temperatures under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative always exceed the 68°F water temperature index value, although water temperatures under the NEPA Modified Flow Alternative would be consistently about 0.3 to about 1.5°F cooler than the NEPA No Action Alternative, when temperatures are stressful to this species and life stage. Water temperatures at the mouth of the Feather River under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would be nearly always essentially equivalent from September through December (Appendix F4, 7 vs. 5, pgs. 825 through 836 and 849 through 860).

Overall, during the entire July through December adult immigration and holding period below the Thermalito Afterbay Outlet and at the mouth of the Feather River, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 1 decrease below the 60°F index value, 1 decrease below the 64°F index value, and 2 increases above the 68°F index values (Appendix G, 7 vs. 5, pgs. G-327 through G-328).

The adult spawning and embryo incubation life stage periodicities of fall-run Chinook salmon in the Feather River are not distinguished from those of the spring-run; therefore these life stages are not evaluated separately. For evaluation of Chinook salmon spawning and embryo incubation under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, see the discussion provided above under spring-run Chinook salmon.

The analytical period for fall-run Chinook salmon juvenile rearing and outmigration on the Feather River extends from November through June. The flows under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative during October through June are described in detail in the discussion provided above for spring-run Chinook salmon smolt emigration. That discussion suggests that the relative flow differences between the operational alternatives during the October through June period would not be expected to substantially affect spring-run Chinook salmon smolt emigration. Therefore, because the fall-run Chinook salmon juvenile outmigration period (November through June) falls within the spring-run Chinook salmon smolt emigration period (October through June), the flow differences from fall through spring also would not be expected to have substantial effects on fall-run Chinook salmon juvenile outmigration.

Specific habitat-discharge relationships for juvenile Chinook salmon rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, water temperatures may be a primary stressor to rearing Chinook salmon juveniles. Therefore, for impact assessment purposes, an examination of water temperatures during November through June is conducted to address potential impacts to juvenile fall-run Chinook salmon rearing in the Feather River. This examination also applies to juveniles migrating downstream because, the thermal requirements of fall-run Chinook salmon juveniles would be equivalent whether the juveniles are rearing or migrating downstream.

Simulated water temperatures under both alternatives would be generally similar for each month of this life stage. From November through April, water temperatures at the Thermalito Afterbay Outlet generally remain below 60°F under both alternatives. Water temperatures during May remain at or below 65°F with about a 90 percent probability, whereas during June water temperatures exceed 65°F with about a 65 percent probability. Overall, the NEPA

Modified Flow Alternative, relative to the NEPA No Action Alternative results in no changes at the 60°F, 63°F, 68°F, 70°F, and 75°F index values and 1 decrease below the 65°F index value (Appendix F4, 7 vs. 5, pgs. 678 through 689 and 702 through 713).

Simulated water temperatures under both alternatives at the mouth of the Feather River would be essentially equivalent from November through April with a probability of at least 97 percent. During May and June, water temperatures under the NEPA Modified Flow Alternative would be measurably warmer than under the NEPA No Action Alternative at primarily intermediate to warm water temperature conditions. Water temperatures are considered to be particularly stressful to rearing juvenile Chinook salmon during June, when water temperatures exceed 70°F with about a 50 percent probability under both alternatives (Appendix F4, 7 vs. 5, pgs. 849 through 860). Overall, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative results in no changes at the 60°F or 65°F index values, 1 increase above the 63°F index value, 3 increases above the 68°F index value, 2 increases above the 70°F index value, and 1 increase above the 75°F index values (Appendix F4, 7 vs. 5, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding conditions due to: (1) generally similar or measurably higher flows at Thermalito Afterbay Outlet and at the mouth of the Feather River during most months of this life stage (July through December); and (2) water temperatures would be consistently about 0.3 to about 1°F cooler at the mouth of the Feather River, when temperatures are stressful to this species and life stage
- Equivalent spawning conditions due to nearly identical spawning habitat availability during the September through December adult spawning period, and nearly identical water temperatures below the Thermalito Afterbay Outlet
- Equivalent embryo incubation conditions due to nearly identical water temperatures and early life stage survival estimates
- Equivalent rearing and outmigration conditions due to: (1) essentially equivalent flows at Thermalito Afterbay Outlet and at the mouth of the Feather River for most months during November through June, which provides similar outmigration conditions; and (2) essentially equivalent water temperatures for juvenile rearing below the Thermalito Afterbay Outlet and at the mouth of the Feather River for most months from November through June

In conclusion, in consideration of potential effects to all life stages of fall-run Chinook salmon, the NEPA Modified Flow Alternative would be expected to result in a less than significant impact to fall-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.9-13: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect steelhead

The analytical period for adult immigration and holding of steelhead in the Feather River extends from August through April. Simulated flows below the Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would be essentially equivalent or measurably higher ranging from about a 90 percent to 100 percent probability for all months of this life stage, except for during October when flows would be measurably lower with about a 30 percent probability. Flows would be also generally equivalent during low flow conditions, with flow increases of ten percent or more only occurring in November with about a 10 percent probability and flow decreases of ten percent or more only occurring in November and March with about a 10 percent and 5 percent probability, respectively (Appendix F4, 7 vs. 5, pgs. 604 through 615 and 628 through 639).

At the mouth of the Feather River, simulated flows under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would be essentially equivalent or measurably higher with a probability ranging from about 80 percent to 97 percent during August through April, except for December, January, February, and April. During these exceptions, flows would be measurably lower with a probability ranging from 30 percent to 60 percent probability; however, the flow reductions primarily occur when flows would be greater than 2,000 cfs and therefore would not be expected to substantially affect steelhead adult immigration and holding (Appendix F4, 7 vs. 5, pgs. 776 through 787 and 800 through 811).

In general, the NEPA Modified Flow Alternative is expected to provide an equivalent or somewhat cooler and therefore more suitable thermal regime for steelhead adult immigration and holding, relative to the NEPA No Action Alternative. For example, water temperatures at Thermalito Afterbay Outlet and at the mouth of the Feather River under both alternatives would be essentially equivalent for at least 97 percent of the cumulative water temperature distribution for each month from August through April (Appendix F4, 7 vs. 5, pgs. 702 through 713 and 800 through 811). Overall, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative results in no changes at either the 52°F or 56°F index values and 7 decreases below the 70°F index value (Appendix G, 7 vs. 5, pg. F-328).

The steelhead spawning season in the Feather River generally extends from December through March. During this life stage, the long-term average annual spawning habitat availability was 57.7 percent of maximum WUA under the NEPA Modified Flow Alternative and 57.8 percent under the NEPA No Action Alternative. Both alternatives provided at least 90 percent of the maximum WUA for about 12 percent of the cumulative WUA distribution. The spawning habitat availability under the NEPA Modified Flow Alternative never differed from that under the NEPA No Action Alternative by 10 percent or more (Appendix F4, 7 vs. 5, pgs. 876 through 878).

From December through March, water temperatures at Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative would be almost always essentially equivalent to water temperatures under the NEPA No Action Alternative. During the adult spawning life stage, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in no changes at any of the steelhead spawning index values (Appendix F4, 7 vs. 5, pgs. 678 through 689).

The embryo incubation period for steelhead in the Feather River generally overlaps with the spawning period, but extends into May. During April and May, water temperatures at Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative would be essentially equivalent to the water temperatures under the NEPA No Action Alternative with a 100 percent and about a 95 percent probability, respectively. Overall, during the embryo incubation life stage at the Thermalito Afterbay Outlet, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in no changes at the 52°F, 54°F, 57°F, or 60°F index values (Appendix F4, 7 vs. 5, pgs. 702 through 713).

Steelhead juveniles are believed to rear in the Feather River year-round. Specific habitat-discharge relationships for juvenile rearing in the Feather River have not been published. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall are typically considered a primary stressor to steelhead juveniles.

Simulated water temperature conditions below the Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative would be essentially equivalent to those under the NEPA No Action Alternative over nearly the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. From November through April, water temperatures generally remain below 60°F under both alternatives. Water temperatures during May remain at or below 65°F with about a 90 percent probability, whereas during June water temperatures exceed 65°F with about a 65 percent probability, always exceed 65°F during July and August, and exceed 65°F with about a 35 percent and 1 percent probability during September and October, respectively. Water temperatures are considered to be particularly stressful to rearing steelhead during July and August, when water temperatures exceed 70°F with about a 30 and 20 percent probability, respectively. Overall, during the year-round steelhead rearing life stage below the Thermalito Afterbay Outlet, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 1 decrease below the 65°F index value, 2 increases above the 68°F index value, 1 increase above the 72°F index value, and no changes at the 75°F index value (Appendix F4, 7 vs. 5, pgs. 702 through 713).

The Feather River steelhead smolt emigration analytical period is believed to extend from October through May. The flows under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative during October through June are described in detail in the discussion provided above for spring-run Chinook salmon smolt emigration. That discussion suggests that the relative flow differences between the operational alternatives during the October through June period would not be expected to substantially affect spring-run Chinook salmon smolt emigration; therefore, because the steelhead smolt emigration period (October through May) falls within the spring-run Chinook salmon smolt emigration period (October through June), the flow differences from fall through spring also would not be expected to have substantial effects on steelhead smolt emigration.

Simulated water temperatures below the Thermalito Afterbay Outlet under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative would be essentially equivalent over nearly the entire cumulative water temperature distributions during the October through May smolt emigration life stage period. With the exception of the winter months of November through February when water temperatures remain cool (< 56°F), water temperatures at the mouth of the Feather River would be warmer than at Thermalito Afterbay Outlet during the October through May smolt emigration life stage. At the mouth of the Feather River, water temperatures under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would be essentially equivalent during October, March, and April with a probability of at least 95 percent. During primarily intermediate to warm water temperature conditions in May, which generally occur during to "drier" water year types, water temperatures would be measurably warmer (by up to about 1°F) under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 678 through 689, 702 through 713, 825 through 836, and 849 through 860).

Overall, during the entire October through May smolt emigration period below the Thermalito Afterbay Outlet, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in no changes at the 52°F, 55°F, and 59°F index values (Appendix F4, 7 vs. 5, pgs. 678 through 689). At the mouth of the Feather River, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, results in no changes at the 52°F or 55°F index values and 1 increase above the 59°F index value (Appendix F4, 7 vs. 5, pgs. 825 through 836).

Based on instream flow, water temperature and spawning habitat availability analyses conducted for this impact assessment, and the analyses of recent monitoring data, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative would be expected to provide:

- Generally equivalent or improved adult immigration and holding conditions due to: (1) essentially equivalent or measurably higher flows for 80 percent to 100 percent of the cumulative flow distribution during most months of this life stage; (2) similar holding habitat conditions; and (3) essentially equivalent or slightly cooler water temperatures during the warm late summer and early fall months in the lower section of the river
- Equivalent spawning habitat availability, and essentially equivalent water temperatures at Thermalito Afterbay Outlet during the December through March adult spawning period
- Essentially equivalent water temperatures at Thermalito Afterbay Outlet over nearly the entire embryo incubation period
- Essentially equivalent water temperatures at Thermalito Afterbay Outlet over nearly the entire year-round juvenile rearing period
- Generally equivalent smolt emigration conditions during the majority of the smolt emigration period (October through May), with lower flows during relatively low flow conditions in May

In conclusion, in consideration of potential effects to all life stages of steelhead, the NEPA Modified Flow Alternative would be expected to result in a less than significant impact to steelhead, relative to the NEPA No Action Alternative.

Impact 10.2.9-14: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect green sturgeon

The analytical period for green sturgeon adult immigration and holding extends from February through July. Simulated flows below the Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would be essentially equivalent or measurably higher ranging from about an 80 percent to 100 percent probability all months of this life stage. Simulated flows below the Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative, relative to under the NEPA No Action Alternative would be higher by ten percent or more during this life stage with a 15 percent probability in May and would be lower by ten percent or more 1 percent during March, April, and July, and about 5 percent during June. During relatively low flow conditions, flows would be higher by 10 percent or more with about a 10 percent probability during May. Conversely, during relatively low flow conditions, flows would be lower by ten percent or more with about a 5 percent probability in March and about a 15 percent probability during June (Appendix F4, 7 vs. 5, pgs. 628 through 639 and 702 through 713).

This temporal trend in flow changes also occurs at Shanghai Bench and at the mouth of the Feather River, with the exception that flows during low flow conditions in April, May, and June would be generally lower under the NEPA Modified Flow Alternative than under the NEPA No Action Alternative. For example, during low flow conditions at Shanghai Bench, flows would be lower by ten percent or more with about a 25 percent probability during April and about a 55 percent probability during May and June. Conversely, flows would be higher by ten percent or more with about a 10 percent probability during July. Based on the frequency and magnitude of the flow changes observed in the monthly mean flow data, as well as in the data for long-term average flows, average flows by water year type, and flow exceedance, flows during the green sturgeon immigration and holding life stage would be expected to provide similar conditions for upstream migration and holding under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 751 through 762 and 800 through 811).

Because the analytical period for green sturgeon spawning (i.e., March through July) falls within the adult immigration and holding analytical period, flows under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative also would be expected to provide similar conditions for the spawning life stage.

Relative to the NEPA No Action Alternative, water temperatures under the NEPA Modified Flow Alternative would be expected to provide similar conditions during each of the adult immigration and holding, spawning, and embryo incubation life stages. From February through July at Thermalito Afterbay Outlet, water temperatures under both alternatives would be essentially equivalent with a probability of at least 95 percent. At the mouth of the Feather River, water temperatures under both alternatives also would be essentially equivalent during February through April with a probability of at least 97 percent. During May and June water temperatures would be measurably warmer at primarily intermediate to warm conditions for about 30 percent and 20 percent of the cumulative water temperature distribution, respectively. During July, water temperatures under the NEPA Modified Flow Alternative would be measurably cooler, relative to the NEPA No Action Alternative for about 60 percent of the cumulative water temperature distribution and would be essentially equivalent for the remainder of the distribution (Appendix F4, 7 vs. 5, pgs. 849 through 860).

During the adult immigration and holding life stage at the Thermalito Afterbay Outlet and at the mouth of the Feather River, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, results in one increase above the 61°F index value. During the adult spawning and embryo incubation life stages, which are evaluated at the Thermalito Afterbay Outlet, but not at the mouth of the Feather River, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, results in 2 increases above the 68°F index value (Appendix F4, 7 vs. 5, pgs. 678 through 689 and 825 through 836).

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Specific habitat-discharge relationships for green sturgeon juvenile rearing have not been developed for the Feather River. Year-round flows below the Thermalito Afterbay Outlet, and at the mouth of the lower Feather River have been generally described above under the spring-run Chinook salmon, fall-run Chinook salmon, and steelhead life stage evaluations. In general, the available information suggests that physical habitat for this life stage would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juveniles.

Relative to the NEPA No Action Alternative, water temperatures under the NEPA Modified Flow Alternative would be expected to provide similar conditions during the juvenile rearing life stage. Simulated water temperature conditions below the Thermalito Afterbay Outlet under the NEPA Modified Flow Alternative would be essentially equivalent to those under the NEPA No Action Alternative over nearly the entire cumulative water temperature distributions each month of the year-round juvenile rearing period. For example, the water temperatures at this location under the alternatives would be essentially equivalent for at least 95 percent of the cumulative water temperature distribution during any given month (Appendix F4, 7 vs. 5, pgs. 702 through 713). Simulated water temperatures at the mouth of the Feather River under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would be essentially equivalent from September through April with a probability of at least 90 percent, would be slightly warmer during May and June, and would be cooler during July and August. Overall, during the year-round juvenile green sturgeon rearing life stage at both locations, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in 1 increase above the 66°F index value (Appendix F4, 7 vs. 5, pgs. 849 through 860).

The analytical period for the juvenile emigration life stage extends from May through September. Trends in flows during this life stage are encompassed in the description above for spring-run Chinook salmon adult immigration and holding. Similar to the green sturgeon juvenile rearing life stage, the available information suggests that physical habitat for green sturgeon juvenile emigration would not be limited under the flow regimes anticipated for either operational scenario. Instead, relatively warm water temperatures from spring through fall may represent a primary stressor to green sturgeon juvenile emigration. As described in the discussion for juvenile rearing, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative is expected to primarily provide essentially equivalent water temperature conditions year-round, with the exceptions of slightly warmer conditions during May and June, and cooler conditions during July and August.

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative would expected to provide:

- Generally equivalent adult immigration and holding, adult spawning and embryo incubation conditions because of corresponding upstream migration and spawning flow-related habitat availabilities, and suitable water temperatures during adult immigration and holding
- Generally equivalent over-summer rearing and juvenile emigration conditions due to generally equivalent water temperatures

In conclusion, in consideration of potential effects to all life stages of green sturgeon, the NEPA Modified Flow Alternative would be expected to result in a less than significant impact to green sturgeon, relative to the NEPA No Action Alternative.

Impact 10.2.9-15: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect American Shad

Despite being non-native, American shad are considered an important sport fish in the Central Valley. As previously described in Section 10.1.2.3, American shad populations in the Central Valley are regional in nature, and high spring flows in tributaries relative to mainstem rivers appear to attract spawning shad into Central Valley tributaries, including the lower Feather River. As discussed above for lower Yuba River American shad, shifting of proportional flows (lower Feather River flows/Sacramento River flows) may simply re-allocate shad from the Sacramento River to the lower Feather River, or *visa versa*. Such shifting of proportional flows may provide for localized angling opportunities, and may not be associated with Central Valley shad production. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for American shad attraction into the lower Feather River.

Over the entire 72-year evaluation period, the change in long-term average percentage of lower Feather River flow, measured at its mouth, to Sacramento River flow, measured downstream of its confluence with the Feather River, is 0.1 percent lower during April, 0.3 percent lower during May, and 0.4 percent lower during June under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Under the NEPA Modified Flow Alternative, during wet and above normal years the there is no change in long-term average percentage of lower Feather River flow to Sacramento River flow during May, April or June. During below normal years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.2 percent lower during April, and 0.4 percent lower during May, with no change during June. During dry years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.6 percent lower during April, and 0.8 percent lower during May and June. During critical years the change in long-term average percentage of lower Feather River flow to Sacramento River flow is 0.3 percent lower during April, 2.8 percent lower during May, and 3.8 percent lower during June (Appendix F4, 7 vs. 5, pgs. 775 and 882).

American shad adult immigration and spawning would not be expected to be significantly affected by changes in flows under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. The lower proportionate flows, particularly in May and June of critical years, would not be expected to significantly affect American shad attraction into the lower Feather River because the probability of occurrence of critical years is low, and because proportionate flows would be fairly similar in wet, above normal and below normal years.

Differences in water temperature between the Sacramento and lower Feather rivers at their confluence may be another important factor in attracting shad to one or the other of these rivers to spawn. Overall, during the April through June American shad adult immigration and spawning life stage, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in two less occurrences (out of the 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage at Feather River mouth (Appendix F4, 7 vs. 5, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative would be expected to provide changes in proportionate lower Feather River to Sacramento River flows, and water temperatures within the reported range of suitable spawning temperatures, that would result in less than significant impacts to American shad.

Impact 10.2.9-16: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect striped bass

Also non-native to California, striped bass are an important sport fish in the Central Valley. Proportionate lower Feather River flows to Sacramento River flows are examined to evaluate the potential for striped bass attraction into, spawning and initial rearing in, the lower Feather River. Striped bass spawning and initial rearing in the lower Feather River extends from April through June. Proportionate flow changes resulting from implementation of the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative during April, May and June are previously described (see American shad discussion, above).

Striped bass adult attraction into the lower Feather River, spawning, embryo incubation, and initial rearing would not be expected to be significantly affected by changes in flows under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. The lower proportionate flows, particularly in May and June of critical years, would not be expected to significantly affect striped bass attraction into, and spawning and initial rearing in the lower Feather River because the combined probability of occurrence of critical years is low, and because proportionate flows would be fairly similar in wet, above normal and below normal years.

Overall, during the April through June striped bass adult spawning, embryo incubation, and initial rearing life stage, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in three less occurrences when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage at the mouth of the Feather River (Appendix F4, 7 vs. 5, pgs. 825 through 836).

Based on the instream flow and water temperature analyses conducted for this impact assessment, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative is expected to provide changes in proportionate lower Feather River to Sacramento River flows, and water temperatures within the reported range of suitable spawning and initial rearing water temperatures, that would result in a less than significant impact to striped bass.

Impact 10.2.9-17: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail spawning, embryo incubation, and initial rearing life stages in the lower Feather River occur from February through May. Over the entire 72-year period of simulated February through May estimates of usable flooded area (UFA), long-term average UFA in the lower Feather River is 0.1 percent higher under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, with average estimates of UFA by water year type ranging from 1.2 percent higher during dry years to 0.4 percent lower during below normal years. Changes of 10 percent or more in UFA do not occur over more than 10 percent of the cumulative UFA distributions (Appendix F4, 7 vs. 5, pgs. 879 through 880).

Over the entire 71-year simulation period, February through May monthly mean water temperatures below the Thermalito Afterbay Outlet, under both the NEPA Modified Flow Alternative and NEPA No Action Alternative remain within the 45 - 75°F range of water temperatures reported to be suitable for splittail spawning (Appendix F4, 7 vs. 5, pgs. 825 through 836).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative is expected to provide generally equivalent conditions for Sacramento splittail in the lower Feather River. In conclusion, the NEPA Modified Flow Alternative would result in a less than significant impact to Sacramento splittail, relative to the NEPA No Action Alternative.

SACRAMENTO RIVER BASIN

Sacramento River

The following sections describe and discuss flow and water temperature differences between the NEPA Modified Flow Alternative and the NEPA No Action Alternative, and potential effects on fisheries and aquatic resources in the Sacramento River immediately downstream of the Feather River confluence and at Freeport.

Model output demonstrates relatively minor and infrequent, but measurable changes in flows the Sacramento River downstream of the Feather River confluence. For example, for the 864 months simulated for the Sacramento River immediately below the Feather River confluence, only 9 monthly mean flows indicate that a 10 percent or greater change under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative – one increase of 11.0 percent (8,982 versus 8,091 cfs) in October, one increase of 12.1 percent (8,243 versus 7,352 cfs) in November, one decrease of 11.3 percent (7,834 versus 8,832 cfs) in April, two decreases of 13.7 percent (6,285 versus 7,285 cfs) and 11.1 percent (7,976 versus 8,976 cfs) in May, two decreases of 15.5 percent (8,138 versus 9,627 cfs) and 10.8 percent (12,066 versus 13,522 cfs) in June, and two increases of 10.1 percent (9,971 versus 9,055 cfs, and 11,887 versus 10,797 cfs) in August. The cumulative flow distributions for the NEPA Modified Flow Alternative and the NEPA No Action Alternative, both immediately below the Feather River confluence and at Freeport, demonstrate: generally equivalent flows during October, November, February and March; slight (< 3 percent) flow decreases at low to intermediate flow levels during December, January and April; slight (< 5 percent) flow decreases at low flow levels during May and June; and slight (generally < 5 percent) flow increases about 60, 80, and 35 percent of the time during July, August and September, respectively. At Freeport, only three flow changes of greater than 10 percent would occur – a 13.2 percent (13,251 versus 12,462 cfs) and 11.4 percent (7,788 versus 8,788 cfs) decrease during May, and a 13.6 percent (9,491 versus 10,980 cfs) decrease during June, under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 907 through 918 and 1030 through 1041).

Water temperatures in the Sacramento River immediately downstream of the Feather River confluence generally remain similar under the NEPA Modified Flow Alternative and the NEPA No Action Alternative during most months. In fact, of the 852 months simulated below the Feather River confluence, 13 months indicate that measurably warmer (> 0.3°F) water temperatures would occur under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, including one water temperature increase each in April and August, two water temperature increases during June and nine increases during May – none of which would exceed 0.6°F. By contrast, water temperatures would be measurably cooler (< 0.3°F) under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative in 44 months of the 852 months simulated in the Sacramento River immediately downstream of the Feather River confluence, including one water temperature decrease each in October, January, March and May, 18 decreases in July, 19 decreases during August, and three decreases during September, with water temperature decreases of not more than 1.0°F. Moreover, of the 852 months simulated at Freeport, only one May displays measurably warmer (> 0.3°F) water temperatures, while one October, one January, one March, one September, five Julys and three Augusts display measurably cooler (< 0.3°F) water temperatures under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, with water temperature differences not exceeding 0.6°F. Immediately downstream of the Feather River confluence, the cumulative water temperatures distributions for the NEPA Modified Flow Alternative and the NEPA No Action Alternative demonstrate generally equivalent water temperatures in all months of the year with the minor exceptions of May, July and August. Under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, water temperatures would be slightly (< 0.5°F) but infrequently (about 5 percent of the time) warmer during May, and would be slightly (< 0.5°F) but infrequently (about 10 percent of the time) cooler during

July and August. Water temperatures would be essentially equivalent at Freeport during all months of the year (Appendix F4, 7 vs. 5, pgs. 957 through 968 and 1055 through 1066).

Impact 10.2.9-18: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect winter-run Chinook salmon

The winter-run Chinook salmon adult immigration and holding life stage occurs in the Sacramento River from December through July. The flow and water temperature differences between the NEPA Modified Flow Alternative and the NEPA No Action Alternative, described above, would not be expected to substantially affect the Sacramento River winter-run Chinook salmon adult immigration and holding life stage due to:

- By May, the majority of adult winter-run Chinook salmon returning to the Sacramento River to spawn have already migrated upstream of the lower Feather River confluence;
- Relatively minor and infrequent changes in flows and water temperatures at the lower Feather River confluence and at Freeport ; and
- Overall, for the 568 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in 1 increase above the 64°F index value and 1 increase above the 68°F water temperature index value immediately downstream of the Feather River confluence, and in 1 increase above the 64°F index value at Freeport (Appendix F4, 7 vs. 5, pgs. 883 through 894 and 1006 through 1017).

The juvenile rearing and outmigration life stage extends from June through April. The relatively minor and infrequent changes in flows and water temperatures at the lower Feather River confluence and at Freeport (described above) would not be expected to substantively affect juvenile rearing and outmigration. Overall, for the 781 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any of the juvenile rearing and outmigration water temperature index values, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 7 vs. 5, pgs. 883 through 894, 957 through 968, 1006 through 1017, 1055 through 1066, and Appendix G, 7 vs. 5, pg. G-336).

In conclusion, in consideration of potential effects to all relevant life stages of winter-run Chinook salmon, the NEPA Modified Flow Alternative would result in a less than significant impact to winter-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.9-19: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon

Spring-run Chinook salmon adult immigration and holding extends from February through September. As discussed above, only relatively minor and infrequent changes in flows and water temperatures would occur at the lower Feather River confluence and at Freeport, which would not be expected to substantively affect adult immigration and holding. Moreover, for the 568 months included in the analysis immediately downstream of the Feather River confluence, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative overall would result in 1 increase above the 64°F index value, and 1 increase above the 68°F index value, while at Freeport, the NEPA Modified Flow Alternative would result in 1 increase above the 64°F index value (Appendix F4, 7 vs. 5, pgs. 883 through 894, 957 through 968, 1006 through 1017, 1055 through 1066, and Appendix G, 7 vs. 5, pg. G-338).

Juvenile rearing occurs year-round in the lower Feather River. Overall, for the 852 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative results in 1 increase above the 68°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the juvenile rearing water temperature index values at Freeport. Smolt emigration occurs from October through June. For the 639 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in 1 increase above the 64°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the smolt emigration water temperature index values at Freeport. Based on the flow and water temperature modeling results described above, the relatively minor changes that occur in flows and water temperatures would not be expected to substantially affect spring-run Chinook salmon juvenile rearing or smolt emigration (Appendix F4, 7 vs. 5, pgs. 957 through 968 and 1055 through 1066).

In conclusion, in consideration of potential effects to all relevant life stages of spring-run Chinook salmon, the NEPA Modified Flow Alternative would result in a less than significant impact to spring-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.9-20: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon

Fall-run Chinook salmon adult immigration and holding extends from July through December. Overall, for the 426 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any of the adult immigration and holding water temperature index values, both immediately downstream of the Feather River confluence and at Freeport. Juvenile rearing and outmigration extends from December through June. For the 497 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in 1 increase above the 68°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the juvenile rearing and outmigration index values at Freeport (Appendix F4, 7 vs. 5, pgs. 957 through 968 and 1055 through 1066).

As discussed above, based on the flow and water temperature modeling results, the relatively minor changes that occur in flows and water temperatures would not be expected to substantially affect adult immigration and holding, or juvenile rearing and outmigration.

In conclusion, in consideration of potential effects to all relevant life stages of fall-run Chinook salmon, the NEPA Modified Flow Alternative would result in a less than significant impact to fall-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.9-21: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect late fall-run Chinook salmon

Late fall-run Chinook salmon adult immigration and holding extends from October through April. Overall, for the 497 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any of the adult immigration and holding water temperature index values, both immediately downstream of the Feather River confluence and at Freeport. Juvenile rearing and outmigration extends from April through December. For the 639 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in 1 increase above the 68°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any of the juvenile rearing and outmigration index values at Freeport (Appendix F4, 7 vs. 5, pgs. 957 through 968 and 1055 through 1066).

Based on the flow and water temperature modeling results described above, the relatively minor changes that occur in flows and water temperatures would not be expected to substantially affect late fall-run Chinook salmon adult immigration and holding, or juvenile rearing and outmigration.

In conclusion, in consideration of potential effects to all relevant life stages of late fall-run Chinook salmon, the NEPA Modified Flow Alternative would result in a less than significant impact to late fall-run Chinook salmon, relative to the NEPA No Action Alternative.

Impact 10.2.9-22: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect steelhead

In the Sacramento River, the steelhead adult immigration and holding life stage period extends from August through March. Overall, for the 568 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in 1 decrease below the 70°F index value immediately downstream of the Feather River confluence, and in no increases above or decreases below any index value at Freeport. The steelhead juvenile rearing life stage occurs year-round. For the 852 months included in the analysis, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would result in 3 decreases below the 72°F index value and 1 increase above the 68°F index value immediately downstream of the Feather River confluence, and in 1 decrease below the 72°F index value at Freeport. The steelhead smolt emigration life stage extends from October through May. Overall, for the 426 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in no increases above or decreases below any water temperature index value, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 7 vs. 5, pgs. 957 through 968 and 1055 through 1066).

Based on the flow and water temperature modeling results described above, the relatively minor changes that occur in flows and water temperatures would not be expected to substantially affect steelhead adult immigration and holding, juvenile rearing, or smolt emigration.

In conclusion, in consideration of potential effects to all relevant life stages of steelhead, the NEPA Modified Flow Alternative would result in a less than significant impact to steelhead, relative to the NEPA No Action Alternative.

Impact 10.2.9-23: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect green sturgeon

Green sturgeon adult immigration and holding extends from February through July, adult spawning and embryo incubation extend from March through July, juvenile rearing occurs year-round, and juvenile emigration occurs May through September. As discussed above, only relatively minor and infrequent changes occur in flows and water temperatures, which would not be expected to substantially affect these green sturgeon life stages. Additionally, for the 355 months included in the analysis of green sturgeon spawning and embryo incubation in the Sacramento River, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in 1 increase above the 68°F index value immediately downstream of the Feather River confluence (Appendix F4, 7 vs. 5, pgs. 907 through 918, 981 through 992, 1030 through 1041, and 1079 through 1090).

In conclusion, in consideration of potential effects to all relevant life stages of green sturgeon, the NEPA Modified Flow Alternative would result in a less than significant impact to green sturgeon, relative to the NEPA No Action Alternative.

Impact 10.2.9-24: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect American shad

American shad adult immigration and spawning extends from April through June. Based on the flow and water temperature modeling results discussed above, the relatively slightly lower flows and slightly warmer water temperature during May, together with the generally equivalent flows and water temperatures during April and June would not be expected to substantially affect American shad adult immigration and spawning. Additionally, during the April through June American shad adult immigration and spawning life stage, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in no additional occurrences (out of the 213 months included in the analysis) when water temperatures would be within the 60°F to 70°F range of reported suitable water temperatures for this expanded life stage, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 7 vs. 5, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the NEPA Modified Flow Alternative would result in a less than significant impact to American shad, relative to the NEPA No Action Alternative.

Impact 10.2.9-25: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect striped bass

Striped bass adult spawning, embryo incubation and initial rearing extend from April through June. Based on the flow and water temperature modeling results discussed above, the relatively slightly lower flows and slightly warmer water temperature during May, together with the generally equivalent flows and water temperatures during April and June would not be expected to substantially affect striped bass adult spawning, embryo incubation and initial rearing. Additionally, for the 213 months included in the analysis, the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative would result in 1 less occurrence when water temperatures would be within the 59°F to 68°F range of reported suitable water temperatures for this expanded life stage, both immediately downstream of the Feather River confluence and at Freeport (Appendix F4, 7 vs. 5, pgs. 957 through 968 and 1055 through 1066).

In conclusion, the NEPA Modified Flow Alternative would result in a less than significant impact to striped bass, relative to the NEPA No Action Alternative.

Impact 10.2.9-26: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect Sacramento splittail

Sacramento splittail adult spawning, embryo incubation and initial rearing extend from February through May. Over the 72-year simulation period, the frequency with which the Yolo Bypass floodplains would be inundated with Sacramento River water would be the same under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative. In the Sacramento River immediately downstream of the lower Feather River confluence, for the 288 months included in the analysis, the NEPA Modified Flow Alternative would provide one fewer month with monthly mean flows greater than 56,000 cfs. These results suggest that the availability of splittail spawning, egg incubation, and initial rearing habitat would be essentially the same under the NEPA Modified Flow Alternative and the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 883 through 894).

Over the 72-year simulation period, the February through May monthly mean water temperatures on the Sacramento River immediately downstream of the lower Feather River confluence under both the NEPA Modified Flow Alternative and the NEPA No Action Alternative would always within the suitable range (i.e., 45°F to 75°F) for splittail spawning (Appendix F4, 7 vs. 5, pgs. 957 through 968).

Based on the flow and water temperature analyses conducted for this EIR/EIS, it is concluded that, relative to the NEPA No Action Alternative, the NEPA Modified Flow Alternative would result in a less than significant impact to Sacramento splittail.

10.2.9.3 DELTA REGION

The evaluation of biological impacts on delta fisheries resources and their habitats use parameters established by the USFWS, CDFG, NMFS and others, including X2 locations, Delta outflows and E/I ratios, presented below.

X2 LOCATION

Over the entire 72-year period of simulated X2 locations, long-term average X2 location under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would range from 0.2 km higher during June (70.6 versus 70.4 km) to 0.1 km lower during October (86.3 versus 86.4 km) and September (84.5 versus 84.6 km). Under the NEPA Modified Flow Alternative, average X2 location by water year type would range from: 0.1 km higher during January (68.5 versus 68.4 km) and May (59.2 versus 59.1 km) to 0.2 km lower during September (83.4 versus 83.6 km) in wet years; 0.1 km higher during December (82.1 versus 82.0 km), January(79.2 versus 79.1 km) and February (68.9 versus 68.8 km) to 0.2 km lower during September (83.4 versus 83.6 km) in above normal years; 0.3 km higher during February (75.3 versus 75.0 km) to 0.1 km lower during August (80.0 versus 80.1 km) and September (85.8 versus 85.9 km) in below normal years; 0.2 higher during February (79.9 versus 79.7 km) to 0.1 km lower during October (87.4 versus 87.5 km) and November (86.7 versus 86.8 km) in dry years; and 0.4 km higher during June (82.2 versus 81.8 km) to no change during October, December through March, and May in critical years (Appendix F4, 7 vs. 5, pg. 1189).

Cumulative X2 location distributions for the NEPA Modified Flow Alternative and the NEPA No Action Alternative would generally overlap during each month of the year, indicating that the X2 location under each scenario would be downstream of compliance points in the Delta with nearly equal probabilities. Although rare, monthly mean X2 location would occasionally change by 1.0 km or more, including the following occasions: (1) two upstream movements (1.3 km and 1.8 km) during January (2) two upstream movements (1.0 km and 1.0 km) during February; and (3) three upstream movements (1.3 km, 1.3 km, and 1.0 km) during June. Changes in X2 location of 1.0 km or more result in the upstream movement of X2 past the designated compliance point of the Confluence on 4 occasions (Appendix F4, 7 vs. 5, pgs. 1214 through 1225).

Over the entire 72-year simulation period during the delta smelt spawning season (February through June), the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, would result in a 0.5 km or greater upstream shift while X2 is located between Chipps Island and the Confluence compliance points during 13 out of 360 months included in the analysis. These upstream shifts would occur 7 times during February and 6 times during June (Appendix F4, 7 vs. 5, pgs. 1190 through 1201).

DELTA OUTFLOW

Over the entire 72-year period of simulated Delta outflow, long-term average Delta outflow under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would range from 1 percent higher during July (6,759 versus 6,725 cfs) and August (4,295 versus 4,245 cfs) to 1 percent lower during November (8,941 versus 9,011 cfs), December (20,560 versus 20,703 cfs) and January (35,191 versus 35,371 cfs). Under the NEPA Modified Flow Alternative, average Delta outflow by water year type would range from: 3 percent higher during August (4,144 versus 4,032 cfs) to 1 percent lower during December (46,816 versus 47,150 cfs) in wet years; 2 percent higher during August (4,452 versus 4,366 cfs) to 2 percent lower during November (9,710 versus 9,935 cfs) in above normal years; 1 percent higher during July (6,416 versus 6,369 cfs), August (3,790 versus 3,741 cfs) and September (3,695 versus 3,652) to 3 percent lower during January (17,846 versus 18,420 cfs) in below normal years; 1 percent higher during March (17,466 versus 17,362 cfs) to 2 percent lower during November (6,683 versus 6,787 cfs) and January (8,726 versus 8,905 cfs) in dry years; and 1 percent higher during December (5,214 versus 5,183 cfs) to 5 percent lower during May (5,362 versus 5,670 cfs) in critical years (Appendix F4, 7 vs. 5, pg. 1140).

Over the 72-year period of simulation the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would result in increases in the percentage of Delta outflows of 5 percent or more in 7 out of 864 months included in the analysis, and decreases of 5 percent or more in 29 out of 864 months (Appendix F4, 7 vs. 5, pgs. 1141 through 1152).

EXPORT-TO-INFLOW RATIO

Delta E/I ratio limits are built into the CALSIM modeling assumptions and, therefore, are consistently met under both the Proposed Action and Environmental Baseline during all months of the year. Nevertheless, over the entire 72-year period of simulated E/I ratios, long-term average E/I ratio would range from 1 percent higher during December, January, May, and August to 2 percent lower during June under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pg. 1238). Under the NEPA Modified Flow Alternative, average E/I ratio by water year type would range from: 1 percent higher during December, July, and August to no change during all other months in wet years; 1 percent higher during November, January, and August to 1 percent lower during July in above normal years; 2 percent higher during January to 1 percent lower during July in below normal years; 1 percent higher during November through January, May, and August to 2 percent lower during June in dry years; and 4 percent higher during May to 17 percent lower during June in critical years. Over the 72-year period of simulation the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would result in a maximum increase of 4 percent, and a maximum decrease of 8 percent in the E/I ratios during any month included in the analysis (Appendix F4, 7 vs. 5, pgs. 1239 through 1250).

SALVAGE ESTIMATION

Delta Smelt

The combined overall estimated salvage for delta smelt at the CVP and SWP salvage facilities under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would decrease by 0.4 percent (average salvage of 105,635 and 106,045, respectively). The combined estimated salvage by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative changes by: (1) 0.1 percent increase during wet (average salvage of 144,448 versus 144,355) and above normal (average salvage of 108,311 and 108,218) years; (2) 0.1 percent decrease during below normal (average salvage of 122,786 and 122,912) and dry years (average salvage of 97,482 and 97,586); and (3) 3.5 percent decrease during critical years (average salvage of 55,149 and 57,151) (Appendix F4, 7 vs. 5, pg. 1336).

Winter-run Chinook Salmon

The combined overall estimated salvage for winter-run Chinook salmon at the CVP and SWP salvage facilities would decrease by 0.1 percent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (average salvage of 13,994 and 14,007, respectively). The combined estimated salvage by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would change by: (1) does not change during wet years; (2) 0.1 percent increase during above normal years (average salvage of 14,634 versus 14,620); (3) does not change during below normal years, (4) 0.5 percent decrease during dry years (average salvage of 14,478 versus 14,556); and (5) 0.1 percent decrease during critical years (average salvage of 9,564 versus 9,573) (Appendix F4, 7 vs. 5, pg. 1324).

Spring-run Chinook Salmon

The combined overall estimated salvage and the combined estimated salvage by water year type for spring-run Chinook salmon at the CVP and SWP salvage facilities would not change with the exception of dry years in which it would decrease by 0.5 percent (average salvage of 24,513 versus 24,629) under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pg. 1324).

Steelhead

The combined overall estimated salvage for steelhead at the CVP and SWP salvage facilities would decrease by 0.1 percent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (average salvage of 3,840 and 3,843, respectively). The combined estimated salvage by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would change by: (1) does not change during wet, above normal, and below normal years; (2) 0.4 percent decrease during dry years (average salvage of 2,759 versus 2,769); and (3) 0.2 percent decrease during critical years (average salvage of 1,807 versus 1,810) (Appendix F4, 7 vs. 5, pg. 1333).

Striped Bass

The combined overall estimated salvage for striped bass at the CVP and SWP salvage facilities would decrease by 0.7 percent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative (average salvage of 3,578,086 and 3,604,029, respectively). The combined estimated salvage by water year type under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would change by: (1) 1.5 percent increase during wet years (average salvage of 4,978,154 versus 4,905,851); (2) 0.1 percent decrease percent in above normal years (average salvage of 4,495,361 versus 4,499,165); (3) does not change during below normal years; (4) 1.8 percent decrease during dry years (average salvage of 2,983,191 versus 3,038,491); and (5) 9.1 percent decrease percent during critical years (average salvage of 1,430,386 versus 1,573,392) (Appendix F4, 7 vs. 5, pgs. 1334 through 1335).

Impact 10.2.9-27: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect delta smelt

Changes in monthly mean location of X2, outflow in the Delta, as well as the E/I ratio, would be relatively infrequent and of minor magnitude under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. In addition, overall delta smelt estimated salvage at the CVP and SWP facilities would decrease by 0.4 percent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated delta smelt salvage, the NEPA Modified Flow Alternative, relative to NEPA No Action Alternative, would result in a less than significant impact to delta smelt (Appendix F4, 7 vs. 5, pgs. 1140, 1189, and 1238).

Impact 10.2.9-28: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect winter-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, would not be expected to substantially affect winter-run Chinook salmon habitat. In addition, overall estimated winter-run Chinook salmon salvage at the CVP and SWP facilities would decrease by 0.1 percent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated winter-run Chinook salmon salvage, the NEPA Modified Flow Alternative, relative to NEPA No Action Alternative, would result in a less than significant impact to winter-run Chinook salmon (Appendix F4, 7 vs. 5, pgs. 1140, 1189, and 1238).

Impact 10.2.9-29: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect spring-run Chinook salmon

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, would not be expected to substantially affect spring-run Chinook salmon habitat. In addition, overall estimated spring-run Chinook salmon salvage at the CVP and SWP facilities would not change under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated spring-run Chinook salmon salvage, the NEPA Modified Flow Alternative, relative to NEPA No Action Alternative, would result in a less than significant impact to spring-run Chinook salmon (Appendix F4, 7 vs. 5, pgs. 1140, 1189, and 1238).

Impact 10.2.9-30: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect steelhead

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, would not be expected to substantially affect steelhead habitat. In addition, overall estimated steelhead salvage at the CVP and SWP facilities would decrease by 0.1 percent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated steelhead salvage, the NEPA Modified Flow Alternative, relative to NEPA No Action Alternative, would result in a less than significant impact to steelhead (Appendix F4, 7 vs. 5, pgs. 1140, 1189, and 1238).

Impact 10.2.9-31: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect striped bass

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, would not be expected to substantially affect striped bass habitat. In addition, overall estimated striped bass salvage at the CVP and SWP facilities would decrease by 0.7 percent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative.

Based on consideration of potential effects to Delta parameters including X2 location, Delta outflow and E/I ratio, as well as estimated striped bass salvage, the NEPA Modified Flow Alternative, relative to NEPA No Action Alternative, would result in a less than significant impact to striped bass (Appendix F4, 7 vs. 5, pgs. 1140, 1189, and 1238).

Impact 10.2.9-32: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) could affect other Delta fisheries resources

The relatively minor and infrequent changes in X2 location, monthly mean outflow in the Delta, and E/I ratio, as described above under the NEPA Modified Flow Alternative relative to the NEPA No Action Alternative, would not be expected to substantially affect other Delta fisheries resources habitats. In conclusion, the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would result in a less than significant impact to other Delta fisheries resources (Appendix F4, 7 vs. 5, pgs. 1140, 1189, and 1238).

10.2.9.4 EXPORT SERVICE AREA

SAN LUIS RESERVOIR

Impact 10.2.9-33: Decreases in San Luis Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish

The spawning period for warmwater fish is believed to generally extend from March through June, although the majority of warmwater fish spawning occurs during the months of April and May. Simulated decreases in the water surface elevation of San Luis Reservoir by more than 6 feet per month would occur the same number of times from March through June under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, over the long-term average and by water year type. Therefore, changes in water surface elevations that could occur under the NEPA Modified Flow Alternative would result in a less than significant impact on San Luis Reservoir warmwater fisheries, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 1438 through 1449).

Impact 10.2.9-34: Decreases in San Luis Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish

Long-term average end of month storage volumes under the NEPA Modified Flow Alternative would not change from April through November relative to the NEPA No Action Alternative. Average end of month storage volumes also would not change from April through November during wet and above normal water year types. During below normal water year types, end of month storage volumes would be 1 percent lower from July through November. During dry water year types, end of month storage volumes would be 1 percent lower during most months, with the exceptions of July and August when they would be 2 percent lower. During critical water year types, end of month storage volumes would not change during most months, with the exceptions of May and June when they would be 1 percent lower. These relatively minor and infrequent changes in end-of-month storage that could occur under the NEPA Modified Flow Alternative would result in a less than significant impact on San Luis coldwater fisheries, relative to the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs. 1339 and 1376).

10.3 CUMULATIVE IMPACTS

Hydrologic modeling was used to evaluate the cumulative effects of the Yuba Accord Alternative and other likely changes in CVP/SWP hydrology. The proposed projects that have been adequately defined (e.g., in recent project-level environmental documents or CALSIM II modeling) and that have the potential to contribute to cumulative impacts are included in the quantitative assessment of the Yuba Accord's impacts. For analytical purposes of this EIR/EIS, the projects that are considered well defined and "reasonably foreseeable" are described in Chapter 20, Cumulative Impacts. Additionally, the assumptions used to categorize future hydrologic cumulative conditions that are quantitatively simulated using CALSIM II and the post-processing tools are presented in Appendix D. To the extent feasible, potential cumulative impacts on resources dependent on hydrology or water supply (e.g., fisheries and aquatic resources) are analyzed quantitatively. Because several projects cannot be accurately characterized for hydrologic modeling purposes at this time, either due to the nature of the particular project or because specific operations details are only in the preliminary phases of development, these projects are evaluated qualitatively.

Only those projects that could affect fisheries and aquatic resources are included in the qualitative evaluation that is presented in subsequent sections of this chapter. Although most of the proposed projects described in Chapter 20 could have project-specific impacts that will be addressed in future project-specific environmental documentation, future implementation of these projects is not expected to result in cumulative impacts to regional water supply operations, or water-related and water dependent resources that also could be affected by the Proposed Project/Action or alternatives (see Chapter 20). For this reason, only the limited number of projects that have the potential to cumulatively impact fisheries and aquatic resources in the project study area are specifically considered qualitatively in the cumulative impacts analysis for fisheries and aquatic resources. These projects are:

- Water Storage and Conveyance Projects
  - Shasta Lake Water Resources Investigation (Shasta Lake Enlargement)
  - North-of-the-Delta Off Stream Storage (Sites Reservoir)
  - Upper San Joaquin River Storage Project
  - South Delta Improvements Program (SDIP)
  - 8,500 cfs at Banks (included in SDIP)
  - Folsom Dam Raise Project
- Projects Related to CVP/SWP System Operations
  - Delta Cross Channel Re-operation and Through-Delta Facility
  - Long-Term CVP and SWP Operations Criteria and Plan
  - Central Valley Project Long-term Contract Renewals
  - CVP/SWP Integration Proposition
  - Isolated Delta Facility (Peripheral Canal)
  - Oroville Facilities FERC Relicensing
  - Delta-Mendota Canal Recirculation Feasibility Study
  - Monterey Plus EIR
- Water Transfer and Acquisition Programs
  - Delta Improvements Package
  - Dry Year Water Purchase Program
  - San Joaquin Valley/Southern California Water Exchange
  - City of Stockton Delta Water Supply Project
  - Sacramento River Water Reliability Study
- Ecosystem Restoration and Fisheries Improvement Projects
  - San Joaquin River Restoration Settlement Act (Friant Settlement Legislation)
  - North Delta Flood Control and Ecosystem Restoration Project
  - CALFED Ecosystem Restoration Program
- Local Projects in the Yuba Region
  - South Fish Screen
  - Yuba River Development Project FERC Relicensing

These projects are described in Chapter 20 and qualitatively addressed below.

10.3.1 Environmental Impacts/Environmental Consequences of the Yuba Accord Alternative Cumulative Condition Compared to the Existing Condition

For CEQA, the purpose of the cumulative analysis is to determine whether the incremental effects of the Proposed Project (Yuba Accord Alternative) would be expected to be "cumulatively considerable" when viewed in connection with the effects of past projects, other current projects, and probable future projects (Public Resources Code Section 21083, subdivision (b)(2))[18].

[18] The Guide to the California Environmental Quality Act (Remy et. al. 1999) states that "…although a project may cause an "individually limited" or "individually minor" incremental impact that, by itself, is not significant, the increment may be "cumulatively considerable", and thus significant, when viewed against the backdrop of past, present, and probable future projects. (CEQA Guidelines, § § 15064, subd. (i)(l), 15065, subd. (c), 15355, subd. (b))."

For NEPA, the scope of an EIS must include "Cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement" (40 CFR, §1508.25(a)(2)).

Because the CEQ regulations implementing NEPA and the CEQA guidelines contain very similar requirements for analyzing, and definitions of, cumulative impacts, the discussions of cumulative impacts of the Yuba Accord Alternative Cumulative Condition relative to the Existing Condition will be the basis for evaluation of cumulative impacts for both CEQA and NEPA. In addition, an analysis of the Modified Flow Alternative Cumulative Condition relative to the Existing Condition is provided to fulfill NEPA requirements.

The following sections describe this analysis for the projects discussed in Section 10.3 above.

10.3.1.1 WATER STORAGE AND CONVEYANCE PROJECTS

Enlargement of existing dam and reservoir facilities could involve increasing their flood control pools, which would provide additional storage space and capacity for flood control operations. Provision of additional storage space could affect the timing, magnitude, and frequency of flood control releases and/or spill events. These potential changes in hydrology could affect north of Delta riverine conditions by altering flow and water temperature patterns that could affect special status and other fish species.

Cumulative changes in operations of water storage and conveyance projects could result in cumulative operational changes for the CVP, SWP, and local water supply systems, and could result in new diversions from upstream or Delta sources. The specific operational changes that could result from the range of future storage and conveyance projects currently contemplated would evolve over time as the details of these projects are refined. The general changes that may occur and that could affect special-status and other fish species include:

- Increased surface water diversions and storage;
- Improved water supply reliability and water management flexibility;
- Requirements for compatibility with objectives and continued improvement of Delta water quality;
- Improvements in reservoir coldwater pool management to maintain lower Sacramento River water temperatures;
- Reduced water diversions from the Sacramento River during critical fish migration periods;
- Expanded pumping capacity at the Banks pumping facility, along with improved fish screening mechanisms;
- Improvements in flood conveyance in the north Delta and lower San Joaquin River; and
- Modified Delta Cross Channel operation and screens.

In addition to the construction-related effects of projects other than the Yuba Accord Alternative that are included in the cumulative condition, the potential exists for these projects to cause reduced stream flows or Delta outflows, changed seasonal flows, more water temperature variability, and changes in Delta salinity conditions that could result in effects on fish species. Potential factors that may contribute to cumulative effects on fisheries and aquatic resources in the future may include reduced habitat abundance, impaired species movement, increased loss of fish from diversions, and geographic relocations or restrictions of fish to less suitable habitats. Conveyance program actions could result in reduced frequency and magnitude of net natural flow conditions in the south and central Delta, resulting in reduced system productivity, impaired species movement, and increased loss from diversions.

10.3.1.2 PROJECTS RELATED TO CVP/SWP SYSTEM OPERATIONS

Similar to the general changes described in Section 10.3.1.1, projects related to CVP/SWP system operations have the potential to result in changes in reservoir storage volumes, river flows and water temperatures, and Delta conditions. CVP/SWP system operational changes could affect north of Delta hydrology by altering flow and water temperature patterns (timing, magnitude and frequency), as well as Delta inflows, outflows, X2 location and exports. The potential exists for these projects to cause reduced stream flows or Delta outflows, changed seasonal flows, more water temperature variability, and changes in Delta salinity conditions that could result in effects on fish species. Potential factors that may contribute to cumulative effects on fisheries and aquatic resources in the future may include reduced habitat abundance, impaired species movement, increased direct mortality of fish from diversions, and geographic relocations or restrictions of fish to less suitable habitats.

10.3.1.3 WATER TRANSFER AND ACQUISITION PROGRAMS

Several water projects (e.g., SVWMP, Dry Year Water Purchase Program, CVPIA Water Acquisition Program, in addition to the EWA) could purchase water through groundwater substitution programs. As presently contemplated, water held in reservoirs during April through June generally would be released during July through September under such programs. Except for the EWA Program, no other water transfer programs are currently managing water that would shift the timing of water deliveries, and none are likely to do so (Reclamation *et al.* 2003). Agencies participating in groundwater substitution programs or other water transfer programs could cause reservoirs to release more water during July through September than under existing conditions. Thus, because end-of-September carry-over storage most likely would be lower, the magnitude and timing of subsequent releases could be altered. Reasonably foreseeable water acquisition programs have the potential to reduce flows on the lower Sacramento River and inflows to the Delta which, in turn, have the potential to affect water temperatures in the lower Sacramento River, and Delta outflows, X2 location and other Delta habitat suitability parameters. Potential factors that may contribute to cumulative effects on fisheries and aquatic resources in the future may include reduced habitat abundance, impaired species movement, increased direct mortality of fish from diversions, and geographic relocations or restrictions of fish to less suitable habitats.

10.3.1.4 ECOSYSTEM RESTORATION AND FISHERIES IMPROVEMENT PROJECTS

Ecosystem restoration and fisheries improvement projects would be targeted to improve aquatic habitat conditions within the project study area. Implementation of such other projects, in addition to the Yuba Accord Alternative, could improve instream flow and water temperature conditions, physical habitat availability and ecosystem functions. Over time, habitat restoration actions could improve floodplain development by increasing riparian and wetland habitats, and thereby increasing habitat complexity and diversity.

A number of contemplated ecosystem restoration and fisheries improvement projects are intended to improve, in part, Delta habitat and conditions for fish and wildlife. Although these projects may result in some temporary disturbances of Delta waterways and habitat, these potential short-term cumulative effects would be less than significant, and long-term habitat improvement actions would be beneficial for fish species and the aquatic ecosystem.

10.3.1.5 LOCAL PROJECTS IN THE YUBA REGION

Of the projects identified above, the Yuba River Development Project FERC Relicensing has the potential to affect flow and water temperature regimes in the lower Yuba River. Before the expiration of the Yuba Project FERC license (FERC No. 2246) in 2016, YCWA will undergo a relicensing process that will allow FERC, state and federal resource agencies (CDFG, SWRCB, USFWS, NMFS, etc.), conservation groups, and the general public to propose appropriate changes in operations and land management for the project in consideration of current social and scientific knowledge. For the relicensing process, FERC will prepare an EA or EIS, which will assess the environmental consequences of the proposed future operations of the Yuba Project and compare the potential impacts of proposed alternatives. During the relicensing process, proposed license terms and conditions, and protection, mitigation, and enhancement measures (PM&Es) will be considered. FERC likely will issue a Final EA or EIS and a decision on the license renewal, which is anticipated to include terms and conditions for operating the project. However, it is not anticipated that the new regulatory requirements resulting from the FERC relicensing process will contribute to potentially significant cumulative adverse impacts.

The south screen improvement plan also has the potential to affect fisheries resources in the lower Yuba River. As an outgrowth of the collaborative discussions regarding the Proposed Yuba Accord, YCWA recently executed a letter agreement with CDFG that establishes a process to resolve issues associated with the water diversion and fish screen located on the south bank of the Yuba River immediately upstream from Daguerre Point Dam. The parties that developed the Proposed Yuba Accord's Fisheries Agreement recognize that addressing these issues is an important step in the ultimate improvement of habitat for the lower Yuba River's salmon and steelhead populations. Under this letter agreement, CDFG and YCWA, in coordination with environmental and fisheries interests and the local irrigation districts and mutual water companies that receive their water supplies through the South Canal, will collaborate on development and implementation of a plan to construct a new fish screen at the head of this canal that will comply with applicable federal and state fish screen criteria. The overall plan includes a feasibility study phase, a design study phase, and a construction phase. Completion and implementation of the south screen improvement plan is anticipated to be beneficial to fisheries and aquatic resources, and therefore will not contribute to potentially significant cumulative adverse impacts on these resources.

10.3.1.6 OTHER CUMULATIVE FISHERIES AND AQUATIC RESOURCES IMPACT CONSIDERATIONS

The quantitative operations-related impact considerations for the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, are discussed in Section 10.2.5. Potential impacts identified in Section 10.2.5 are summarized below and provide an indication of the potential incremental contributions of the Yuba Accord Alternative to cumulative impacts. These potential impacts are summarized here:

- Impact 10.2.5-1: Decreases in New Bullards Bar Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish –Less than significant
- Impact 10.2.5-2: Decreases in New Bullards Bar Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish - Less than significant

- Impact 10.2.5-3: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon - Beneficial
- Impact 10.2.5-4: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon – Beneficial
- Impact 10.2.5-5: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect steelhead – Beneficial
- Impact 10.2.5-6: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect green sturgeon - Less than significant
- Impact 10.2.5-7: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect American shad - Less than significant
- Impact 10.2.5-8: Changes in monthly mean flows in the lower Yuba River, or changes in monthly mean water temperatures, could affect striped bass - Less than significant
- Impact 10.2.5-9: Decreases in Oroville Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish - Less than significant
- Impact 10.2.5-10: Decreases in Oroville Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish - Less than significant
- Impact 10.2.5-11: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon – Less than significant
- Impact 10.2.5-12: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon – Less than significant
- Impact 10.2.5-13: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect steelhead – Less than significant
- Impact 10.2.5-14: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect green sturgeon – Less than significant
- Impact 10.2.5-15: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect American Shad – Less than significant
- Impact 10.2.5-16: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect striped bass – Less than significant
- Impact 10.2.5-17: Changes in monthly mean flows in the lower Feather River, or changes in monthly mean water temperatures, could affect Sacramento splittail – Less than significant
- Impact 10.2.5-18: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect winter-run Chinook salmon - Less than significant
- Impact 10.2.5-19: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect spring-run Chinook salmon - Less than significant
- Impact 10.2.5-20: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect fall-run Chinook salmon - Less than significant

- ❑ Impact 10.2.5-21: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect late fall-run Chinook salmon - Less than significant
- ❑ Impact 10.2.5-22: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect steelhead - Less than significant
- ❑ Impact 10.2.5-23: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect green sturgeon - Less than significant
- ❑ Impact 10.2.5-24: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect American shad - Less than significant
- ❑ Impact 10.2.5-25: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect striped bass - Less than significant
- ❑ Impact 10.2.5-26: Changes in monthly mean flows in the Sacramento River, or changes in monthly mean water temperatures, could affect Sacramento splittail - Less than significant
- ❑ Impact 10.2.5-27: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect delta smelt – Less than significant
- ❑ Impact 10.2.5-28: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect winter-run Chinook salmon – Less than significant
- ❑ Impact 10.2.5-29: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect spring-run Chinook salmon - Less than significant
- ❑ Impact 10.2.5-30: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect steelhead – Less than significant
- ❑ Impact 10.2.5-31: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) and salvage estimates could affect striped bass – Less than significant
- ❑ Impact 10.2.5-32: Changes in Delta habitat evaluation parameters (i.e., X2 locations, Delta outflows and E/I ratios) could affect other Delta fisheries resources – Less than significant
- ❑ Impact 10.2.5-33: Decreases in San Luis Reservoir water surface elevations during the spawning/nesting season could affect warmwater fish – Less than significant
- ❑ Impact 10.2.5-34: Decreases in San Luis Reservoir storage could reduce the coldwater pool and thereby affect coldwater fish - Less than significant

Although all of these impacts would be either less than significant or beneficial, the potential nevertheless exists for cumulative impacts. Cumulative impact determinations are presented below, and are based upon consideration of the quantified Yuba Accord Alternative impacts relative to the Existing Condition, in combination with the potential impacts of other reasonably foreseeable projects. These cumulative impact determinations are made by region.

10.3.1.7 *POTENTIAL FOR CUMULATIVE FISHERIES AND AQUATIC RESOURCES IMPACTS WITHIN THE PROJECT STUDY AREA*

Results from the quantitative analysis generally indicate that direct project-related fisheries and aquatic resources impacts would be less than significant. Nevertheless, the Yuba Accord Alternative still could incrementally contribute to cumulative fisheries and aquatic resources impacts within the project study area. The frequency and magnitude of the quantitative hydrologic changes associated with the Yuba Accord Alternative and the other qualitative analytical considerations discussed above were both considered during the development of the overall cumulative impact conclusions discussed below for the Yuba Accord Alternative Cumulative Condition, relative to the Existing Condition.

Impact 10.3.1.7-1: Potential for significant cumulative fisheries and aquatic resources impacts within the Yuba Region

In consideration of the aforementioned quantitative and qualitative cumulative analyses, significant cumulative impacts on fisheries and aquatic resources in the Yuba Region are not expected to occur as a result of implementing the Yuba Accord Alternative in combination with other reasonably foreseeable future local projects in the Yuba Region. In fact, it is anticipated that the two other identified local projects in the Yuba Region would most likely result in beneficial impacts to the fisheries and aquatic resources in the Yuba Region. In addition, reasonably foreseeable future projects outside of the Yuba Region (i.e., CVP/SWP Upstream of the Delta Region, Delta Region, and Export Service Area) would not be expected to result in operational changes of the Yuba Project or have any other effects in the Yuba Region.

Impact 10.3.1.7-2: Potential for significant cumulative fisheries and aquatic resources impacts within the CVP/SWP Upstream of the Delta Region

In consideration of the aforementioned qualitative and quantitative cumulative analyses, significant cumulative impacts on fisheries and aquatic resources in the CVP/SWP Upstream of the Delta Region could occur as a result of implementing the Yuba Accord Alternative in combination with other reasonably foreseeable future projects.

Future levels of demand for water in California will be addressed through the implementation of numerous projects, including the previously identified general categories of: water storage and conveyance projects; projects related to CVP/SWP system operations; and water transfer and acquisition programs. Presently, it is uncertain how the implementation of the various projects within these general categories would change the timing, magnitude and frequency of flows and water temperatures in the CVP/SWP Upstream of the Delta Region. A number of these projects are expected to result in increased water availability and therefore increased CVP/SWP operational flexibility to meet various instream beneficial uses, including protection and management of fisheries and aquatic resources. By contrast, some of these projects are expected to result in decreased operational and management flexibility due to the primary purposes of increased diversions, water supplies and conveyance.

It can be reasonably assumed that each of these projects will be designed to avoid or minimize the adverse impacts to fisheries and aquatic resources associated with its implementation, and therefore individually would result in less than significant impacts. It can also be reasonably assumed, however, that the combination of a number of less than significant impacts for these projects could result in cumulative potentially significant impacts. Therefore, it is concluded that implementation of the Yuba Accord Alternative in combination with other reasonably foreseeable projects could result in potentially significant and unavoidable cumulative impacts to fisheries and aquatic resources in the CVP/SWP Upstream of the Delta Region.

Impact 10.3.1.7-3: Potential for significant cumulative fisheries and aquatic resources impacts within the Delta Region

In consideration of the aforementioned qualitative and quantitative cumulative analyses, significant cumulative impacts on fisheries and aquatic resources in the Delta Region could occur as a result of implementing the Yuba Accord Alternative in combination with past and present projects, and other reasonably foreseeable future projects.

It is uncertain how the implementation of the various reasonably foreseeable projects listed above would change evaluated Delta habitat parameters, exports and salvage within the Delta Region. A number of these projects would be expected to result in increased water availability and therefore increased CVP/SWP operational flexibility to meet various instream beneficial uses, including protection and management of fisheries and aquatic resources. In addition, implementation of ecosystem restoration and fisheries improvement projects could result in improved physical habitat availabilities, although the overall effectiveness of these projects, particularly in consideration of potential future hydrologic changes, is uncertain.

By contrast, some of the previously listed reasonably foreseeable projects are expected to result in decreased operational and management flexibility due to the primary purposes of increased diversions and water supplies associated with future levels of demand, which could result in reduced inflows (potentially affecting Delta habitat parameters) and increased exports (potentially affecting salvage at CVP/SWP facilities).

This EIR/EIS acknowledges that there are numerous issues surrounding the pelagic organism decline, and recognizes that future Delta operations and management will differ from the operations and management that have been in place under the CEQA Existing Condition and the NEPA Affected Environment. As demonstrated by subsequent analyses beginning in Section 10.2.3 of this EIR/EIS, Reclamation has determined that the Proposed Project/Action would have sufficient operational flexibility so that it could be adjusted as necessary to protect listed species and, thus, would not cause irreversible or irretrievable commitments of resources that would limit the ability of NMFS, USFWS or Reclamation to formulate or implement reasonable and prudent alternatives as part of the ongoing 2006/2007 OCAP consultation.[19] As discussed in Section 4.1.4, any conveyance of water provided by the Yuba Accord Alternative through the CVP/SWP system, the Delta and the Export Service Area would be consistent with all of the procedures and operating principles that are established in the new OCAP that Reclamation will adopt after completion of these new consultations. Because any cross Delta transfers for EWA or other purposes must comply with operational requirements placed upon the CVP/SWP, any Delta-related actions of the Proposed Project/Action or an alternative would be compliance with the existing OCAP BOs, or successor documents.

Last year, the governor initiated a comprehensive Delta Vision process and appointed a Blue Ribbon Task Force to recommend future actions that would achieve a sustainable Delta. In addition, many state and federal agencies and environmental groups signed a formal Planning

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[19] Water transfers under the Proposed Action could be implemented in a flexible manner because the conditions under which YCWA would be deemed to have transferred water would depend on: (a) the CVP or SWP having available export pumping capacity at their Delta facilities; or (b) the CVP and SWP having the ability to reduce releases from CVP/SWP project reservoirs to "back up" YCWA water into Oroville Reservoir.

Agreement in September 2006 and are developing Bay Delta Conservation Plan (BDCP) for at-risk fish species under the provisions of the State Natural Community Conservation Planning Act (NCCPA) and the ESA Section 10 that allow for Habitat Conservation Plans (HCP). These efforts also will provide a framework for future action (DWR Website 2007). Regardless of the nature of future actions and protective measures that will arise and be implemented to address the POD issues, implementation of the Proposed Project/Action or an alternative would be subject to any subsequent regulatory or operational constraints and CVP/SWP management direction surrounding pelagic fish species.

It can be assumed that each of the above listed reasonably foreseeable projects would be designed to avoid or minimize adverse impacts to fisheries and aquatic resources associated with its implementation, and therefore individually would result in less than significant impacts. It can also be assumed, however, that the combination of a number of less than significant impacts from these projects, and past and present projects, could result in cumulative potentially significant impacts. At this time, it is not possible to quantitatively ascertain the specific causality or magnitude of cumulative potentially significant impacts, or specific mitigation measures to avoid or minimize these impacts. Therefore, it is concluded that implementation of the Yuba Accord Alternative in combination with other reasonably foreseeable projects could result in potentially significant and unavoidable cumulative impacts to fisheries and aquatic resources in the Delta Region.

Impact 10.3.1.7-4: Potential for significant cumulative fisheries and aquatic resources impacts within the Export Service Area (San Luis Reservoir)

As discussed above in Sections 10.2.5 and 10.2.8, reservoir operations would result in less than significant impacts to warmwater fish or coldwater fish in San Luis Reservoir. Water surface elevation fluctuations and changes in storage resulting from San Luis Reservoir operations to meet increased future demands are not expected to substantially differ from existing operations. San Luis Reservoir currently is a regulating facility for south-of-Delta deliveries and is expected to continue as such in the future with similar operational constraints, such as San Luis Reservoir low point control. Future San Luis Reservoir operations are expected to cause fluctuations (increases and decreases) in water surface elevations, as well as changes in storage, that would be within the range of historical variations and, thus, these changes would remain within the range of seasonal drawdown levels under the Existing Condition. Because reservoir operations will not increase beyond the range of current reservoir operations, it is anticipated that the new projects discussed above would not adversely impact fisheries and aquatic resources in San Luis Reservoir. Therefore, the overall effects on fisheries and aquatic resources associated with San Luis Reservoir would be minor, and the potential cumulative impacts of the Yuba Accord Alternative Cumulative Condition, relative to the Existing Condition, would be less than significant.

10.3.2 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE MODIFIED FLOW ALTERNATIVE CUMULATIVE CONDITION COMPARED TO THE EXISTING CONDITION

It is anticipated that the Modified Flow Alternative Cumulative Condition would have the same potential for cumulative impacts as the Yuba Accord Cumulative Condition. Therefore, the description of the potential impacts in Section 10.3.1 also serves as the description of cumulative impacts associated with the Modified Flow Alternative. Thus, the Modified Flow Alternative Cumulative Condition would result in the following potential cumulative impacts:

- Yuba Region - potential cumulative impacts on fisheries and aquatic resources in the Yuba Region would be less than significant.
- CVP/SWP Upstream of the Delta Region - potential cumulative impacts on fisheries and aquatic resources in the CVP/SWP Upstream of the Delta Region could be potentially significant and unavoidable.
- Delta Region - potential cumulative impacts on fisheries and aquatic resources in the Delta Region could be potentially significant and unavoidable.
- Export Service Area - potential cumulative impacts on fisheries and aquatic resources in the Export Service Area (San Luis Reservoir) would be less than significant.

10.4 POTENTIAL CONDITIONS TO SUPPORT APPROVAL OF YCWA'S WATER RIGHTS PETITION

No unreasonable adverse effects to fisheries and aquatic resources would occur under the Yuba Accord Alternative relative to the No Project Alternative. Therefore, no impact avoidance measures or other protective conditions are identified for SWRCB consideration in determining whether or not to approve YCWA's petitions to implement the Yuba Accord.

By contrast, based upon the modeling characterizations included in this EIR/EIS, the Modified Flow Alternative, relative to the No Project Alternative, may unreasonably adversely affect spring-run Chinook salmon and fall-run Chinook salmon in the lower Yuba River - primarily due to warmer water temperatures during September, May and June under relatively warm water temperature conditions, and lower flows (of 10 percent or greater) during low flow conditions during April, May and June.

However, if the Modified Flow Alternative is pursued, any surface water and groundwater-substitution transfers under the Modified Flow Alternative would be proposed and analyzed by YCWA, and approved by the SWRCB, separately each year. Such individual flow regimes proposed annually under the Modified Flow Alternative would be designed to avoid any unreasonable effects on spring-run and fall-run Chinook salmon or other fisheries and aquatic resources.

10.5 MITIGATION MEASURES/ENVIRONMENTAL COMMITMENTS

Mitigation and impact avoidance measures are presented below for all potentially significant impacts to fisheries and aquatic resources identified above.

Mitigation Measure 10.2.9-3: Annual scheduling of flow regimes for the Modified Flow Alternative to avoid impacts to spring-run Chinook salmon

The Modified Flow Alternative, relative to the No Action Alternative, could result in potentially significant impacts to spring-run Chinook salmon primarily due to warmer water temperatures during May, June and September under relatively warm water temperature conditions, lower flows during low flow conditions during April, May and June, and lower spawning habitat availability.

However, if the Modified Flow Alternative is pursued, any surface water and groundwater-substitution transfers under the Modified Flow Alternative would be proposed and analyzed by YCWA, and approved by the SWRCB, separately each year. Such individual flow regimes proposed annually under the Modified Flow Alternative would be designed to avoid any potentially significant impacts to spring-run Chinook salmon.

Impact Significance After Mitigation: Less than significant.

Mitigation Measure 10.2.9-4: Annual scheduling of flow regimes for the Modified Flow Alternative to avoid impacts to fall-run Chinook salmon

The Modified Flow Alternative, relative to the No Action Alternative, could result in potentially significant impacts to fall-run Chinook salmon primarily due to warmer water temperatures during May, June and September under relatively warm water temperature conditions, and lower flows during low flow conditions during April, May and June.

However, if the Modified Flow Alternative is pursued, any surface water and groundwater-substitution transfers under the Modified Flow Alternative would be proposed and analyzed by YCWA, and approved by the SWRCB, separately each year. Such individual flow regimes proposed annually under the Modified Flow Alternative would be designed to avoid any potentially significant impacts to fall-run Chinook salmon.

Impact Significance After Mitigation: Less than significant.

10.6 POTENTIALLY SIGNIFICANT UNAVOIDABLE IMPACTS

There are no potentially significant unavoidable project-related impacts to fisheries and aquatic resources associated with the implementation of the Proposed Project/Action, or an action alternative, individually. However, the Yuba Accord Alternative, in combination with past, present, or other reasonably foreseeable future projects, could result in potentially significant cumulative impacts on fisheries and aquatic resources in the CVP/SWP Upstream of the Delta Region and the Delta Region. Similarly, the Modified Flow Alternative, in combination with other reasonably foreseeable future projects, could result in potentially significant unavoidable cumulative impacts on fisheries and aquatic resources in the CVP/SWP Upstream of the Delta Region and the Delta Region.

CHAPTER 11
TERRESTRIAL RESOURCES

For an area of its size, California has one of the greatest diversities of natural flora and fauna in North America. California's topography, Mediterranean climate, and soil types provide for a variety of microhabitats and a high degree of endemism – approximately 24 percent of California's plants and a large number of its animals are native exclusively to California (Hickman 1993). Of these unique species, a large percentage is found in California's riparian habitats where snowmelt extends the season of water availability compared to nearby upland xeric communities (Holstein 1984).

Historically, Northern California contained a mosaic of riverine, wetland, and riparian habitat along rivers and streams, with surrounding terrestrial habitats consisting of perennial grasslands and oak woodlands. With settlement, agricultural and urban development converted land from native habitats to cultivated fields, pastures, residences, water impoundments, flood control structures, and other developments. As a result, native habitats in this area generally are restricted in their distribution and size, and now are highly fragmented. Agricultural land comprises most of the non-urbanized region and includes row and field crops, rice, pasture, and orchards (see Chapter 16).

The Proposed Project/Action and alternatives could alter both the magnitude and the timing of flows in the lower Yuba River and CVP/SWP and local river systems, potentially affecting the wetland and riparian vegetation and habitat, storage reservoirs, river corridors, floodplains, and the Delta (see Section 2.1, Project Study Area). Although implementation of the Proposed Project/Action and alternatives would vary with seasonal conditions and water year types, terrestrial resources with the greatest potential to be affected include riparian communities associated with the managed hydrology in the study area. In general, the Fisheries Agreement component of the Yuba Accord Alternative would increase instream flows in the lower Yuba River, thereby potentially affecting the reservoir and river shoreline riparian habitats, and associated wildlife. The Conjunctive Use Agreement component of the Yuba Accord Alternative would substitute groundwater for surface water for irrigation purposes in the YCWA service area during specific year types and, depending on operational details, could potentially affect wildlife species that opportunistically use agricultural fields and the anthropogenic water conveyance structures. The Water Purchase Agreement component could affect how the CVP and SWP are managed, potentially affecting water flows to the CVP/SWP Upstream of the Delta and Delta regions.

11.1 ENVIRONMENTAL SETTING/AFFECTED ENVIRONMENT

This section describes the existing conditions of terrestrial biological resources and consists of (1) identification of communities and associated special-status plant and wildlife species with the potential to both occur in the study area and be affected by the Proposed Project/Action and alternatives (Section 11.1.1); (2) descriptions of the terrestrial landscape within the study area (Section 11.1.2); and (3) documentation of the regulatory setting guiding terrestrial resource management in the study area (Section 11.1.3).

11.1.1 TERRESTRIAL RESOURCES OF THE PROJECT STUDY AREA

As a basis for identifying terrestrial resources that may be affected by the Proposed Project/Action and alternatives, vegetative communities and associated special-status plant and wildlife species existing in the study area were identified by compiling and reviewing existing resource maps and literature descriptions of the study area, including those published in previous environmental documents, technical reports, and by conducting queries of the California Natural Diversity Database (CNDDB) for sensitive species, sensitive wildlife habitats, and native California plant communities. In addition, aerial photographs and photographs taken to support other EIR/EIS resource chapters were reviewed.

Upland habitat types occurring in the study area were primarily categorized using the USGS Gap Analysis of Mainland California (GAP) vegetation categorization system. Although the GAP database provides 100 percent coverage within the study area for upland vegetative communities, it does not distinguish small habitat patches, such as riparian stringers or small wetlands, which can have high wildlife value. GAP data tends to under-represent wetland and riparian habitat because it uses a 99-acre minimum mapping unit for these habitat types[1]. Most wetland areas within California are less than 99 acres and, therefore, are not represented on the GAP maps (CALFED 2000a).

The limitations in the GAP analysis required the use of an additional classification system to identify wetland and riparian habitat types smaller than 99 acres. CDFG's Wetland and Riparian Classification System was utilized, where coverage was available, to identify and describe wetland and riparian communities within the study area. CDFG's Wetland and Riparian Classification System is based on Landsat Thematic Mapper Satellite Imagery and SPOT Multispectral Satellite Imagery (CDFG 1997). The minimum mapping unit for riparian and wetland habitat types is approximately 102 feet.

The vegetative community category descriptions and attributes from the GAP and CDFG's Wetland and Riparian Classification System were then compared to the descriptions and attributes of the vegetative community categories in Holland's (1986) classification system to determine synonymous category nomenclature. Based on these comparisons, it was determined that the study area supports the following primary vegetative communities:

- Seasonally flooded agricultural land
- Orchards and vineyards
- Freshwater emergent wetlands
- Saline emergent wetlands
- Vernal pools
- Valley foothill riparian forest
- Great valley cottonwood riparian forest
- Great valley oak riparian forest
- Foothill pine-oak woodland
- Blue oak woodland

[1] GAP uses a 247-acre minimum mapping unit for upland habitat types (CALFED 2000a).

- Non-native grassland/ruderal
- Mixed conifer
- Montane hardwood
- Chaparral
- Black willow riparian woodland
- Early successional riparian woodland[2]

While all of these habitat types are expected to exist within the study area, not all are expected to be impacted by implementation of the Proposed Project/Action or an alternative. The following sections provide descriptions of those habitats with the potential to be impacted by the Proposed Project/Action and alternatives, the rationale for excluding the remaining habitat types from further consideration, and plant and wildlife species associated with communities that could potentially be impacted.

11.1.1.1 Communities and Habitats Potentially Affected by the Proposed Project/Action and Alternatives

Within the study area, freshwater wetland and riparian communities primarily are dependent on surface water and precipitation, although some reaches of the Feather and lower Sacramento River could be fed by groundwater (see Chapters 6 and 7). Thus, changes in flows within the Yuba, Feather, and lower Sacramento rivers resulting from implementation of the Proposed Project/Action and alternatives have the potential to impact the following communities, all of which occur within the Yuba, Feather, and lower Sacramento river corridors, or along the shoreline of San Luis Reservoir:

- Freshwater emergent wetland
- Valley foothill riparian forest
- Great valley cottonwood riparian forest
- Great valley oak riparian forest
- Early successional riparian woodland

A brief description of each community is provided below.

Freshwater Emergent Wetland

Freshwater emergent wetlands are characterized by specialized plant species that require moist soils and inundation during the growing season. Species composition within and among marshes varies according to hydroperiod, soils, water chemistry, and climate among other factors. The outermost margins of marshes are saturated and inundated only periodically. Moist-soil plant species such as big leaf sedge (*Carex amplifolia*), Baltic rush (*Juncus balticus*), redroot (*Cyperus erythrorhizos*), and nutgrass (*Cyperus esculentus*) inhabit these portions of wetlands. On wetter sites or in portions of marshes with deeper or more regular inundation, cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), and arrowhead (*Sagitaria* spp.) dominate. Thus, the characteristics and distribution of individual species in freshwater emergent wetlands are intimately linked with the marsh's water regime.

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[2] Labeled "riparian woodland" in (Reclamation and CDPR 2005).

Freshwater emergent wetland habitats are among the most productive wildlife habitats in California. They provide food, cover, and water for more than 160 species of birds, and numerous mammal, amphibian, and reptile species. Wildlife commonly found in this habitat type includes waterfowl, songbirds, and a variety of amphibians and rodents. Several species of raptors utilize wetland habitats for foraging.

VALLEY FOOTHILL RIPARIAN FOREST

The valley foothill riparian forest community develops on the floodplains of low-gradient rivers and streams. Riparian forest is a special habitat type represented by transitional areas between aquatic and upland zones, encompassing sharp environmental gradients, unique ecological processes, and diverse communities. Dominant species in the canopy layer include cottonwood (*Populus* spp.), California (western) sycamore (*Platanus racemosa*), and valley oak (*Quercus lobata*). Subcanopy trees include white alder (*Alnus rhombifolia*), box elder (*Acer negundo* var. *californica*), and Oregon ash (*Fraxinus latifolia*). Typical understory shrub layer plants include wild grape (*Vitis californica*), wild rose (*Rosa californica*), California blackberry (*Rubus ursinus*), blue elderberry (*Sambucus mexicana*), poison oak (*Toxicodendron diversilobum*), buttonbush (*Cephalanthus occidentalis*), and willows (*Salix* spp.).

The composition of riparian plant communities is shaped by the timing, intensity, and duration of flooding. Willows predominate in areas subject to regular inundation and quickly colonize newly deposited gravel bars or recently scoured areas. Cottonwoods occur farther from the river channel in areas subject to less frequent and intense flooding. Still, the persistence of cottonwoods is linked to the natural seasonal pattern of flows. Cottonwoods evolved to release seeds synchronistic with the high spring flows that deposit nutrient-rich sediments where germination and seedling survival would be enhanced. Thus, the timing and intensity of flows is critical to the persistence of riparian vegetation. Flood control and water supply projects have resulted in hydrologic alterations that have changed the species composition, structure, and extent of riparian habitats. In addition, most rivers have been channelized and are confined by levees that limit the area available to support riparian habitat. The extent of riparian habitat in the Central Valley has been substantially reduced as a result of these changes. Existing riparian habitat generally consists of narrow bands of vegetation along permanent and seasonal drainages.

Riparian zones provide important resources to both obligate riparian species and upland species. As such, species diversity typically is higher in riparian zones than in upland vegetated zones, and the diversity of wildlife species using these zones is related to plant species diversity. Riparian habitats provide food, water, migration and dispersal corridors, and escape, nesting, and thermal cover for an abundance of wildlife. At least 50 species of amphibians and reptiles occur in lowland riparian systems. Many are permanent residents, while others are transient or temporal visitors. The results of one study conducted on the Sacramento River indicated that 147 bird species were recorded as nesters or winter visitants. Additionally, 55 species of mammals are known to use the Central Valley's riparian communities. Wildlife species associated with riparian areas include a variety of songbirds and raptors, and mammals such as muskrat (*Ondatra zibethica*), otter (*Lutra canadensis*), mink (*Mustela vison*), and beaver (*Castor canadensis*). Special-status species associated with riparian habitat in the Sacramento Valley include Swainson's hawk (*Buteo Swainsoni*), bald eagle (*Haliaectus leucocephalus*), bank swallow (*Riparia riparia*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), and valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). Based on plant species composition, Holland (1986) distinguished several types of riparian forest communities in the

Central Valley. Two prominent types are great valley cottonwood riparian forest and great valley oak riparian forest.

GREAT VALLEY COTTONWOOD RIPARIAN FOREST

Great valley cottonwood riparian forest is a dense, broadleaved, winter-deciduous riparian forest dominated by Fremont's cottonwood (*Populus fremontii*) and Goodding's willow (*Salix gooddingii*). The understory typically is dense. Wild grape commonly is abundant. Scattered seedlings and saplings of shade-tolerant species such as box elder or Oregon ash can occur in the understory, but frequent flooding prevents their reaching canopy height. Great valley cottonwood riparian forest typically is found on fine-grained alluvial soils near perennial or nearly perennial streams that provide subsurface water even when the channel is dry. The sites are inundated yearly during spring, resulting in annual input of nutrients, soil, and new germination sites.

GREAT VALLEY OAK RIPARIAN FOREST

Great valley oak riparian forest is a medium to tall (rarely to 100 feet) broadleaved, winter-deciduous, closed-canopy riparian forest dominated by valley oak. The understory typically includes scattered Oregon ash, black walnut (*Juglans hindsii*), and California sycamore, as well as young valley oaks. Vines such as wild grape often are scattered throughout the shady understory, and conspicuously in the windthrow-generated light gaps. The great valley oak riparian forest community is restricted to the highest parts of floodplains where it is less subject to physical disturbance from flooding, but still receives annual inputs of silty alluvium and can access subsurface water during the dry season.

EARLY SUCCESSIONAL RIPARIAN WOODLAND

Where plant growth and seasonal hydraulic conditions allow, a riparian habitat can develop around reservoir shorelines. The discernable trend of riparian stand succession over mesic expression is limited by the height and hydric avoidance occasioned by an abrupt slope to mesic, unsaturated soil profile conditions. In California, these reservoir riparian habitats are more commonly seen in the gently sloped reservoirs of the Central Valley than the steep canyons of the Sierra foothill reservoirs. Within the study area, this habitat type occurs only around the shoreline of San Luis Reservoir.

11.1.1.2 COMMUNITIES AND HABITATS NOT AFFECTED BY THE PROPOSED PROJECT/ACTION AND ALTERNATIVES

Several project-specific details related to the Proposed Project/Action and alternatives suggest that not all vegetative communities within the study area have the potential to be impacted by the implementation of the Proposed Project/Action or an alternative. For example, conveyance methods and actual amounts of water delivered to agricultural operations will not change as a result of implementing the Proposed Project/Action or an alternative (see Chapter 5 and Section 11.1.2.1). Water for canals, ditches, and runoff will not be interrupted, leaving dependent habitat communities intact.

As a result of these and other project details considered below, several vegetative communities found within the study area are excluded from further consideration in the evaluation of potential effects to the terrestrial resources of the Proposed Project/Action and alternatives. Further details and rationale regarding the exclusion of these habitats can be found below.

SEASONALLY FLOODED AGRICULTURAL LAND

A significant portion of the surface water within the study area is utilized for agricultural purposes. During certain water year types, groundwater will be used by YCWA Member Units as a substitute for a percentage of the water that is delivered to agricultural operations, but the actual amount of water delivered to agricultural operations will not change, nor will the seasonal volumes of water conveyed in water delivery ditches (pers. comm., McDaniel 2006). Operation of the agricultural fields will not changed as a result of the Proposed Project/Action and alternatives, and therefore, seasonally flooded agricultural lands and conveyance ditches, and associated terrestrial resources, will not be affected by the Proposed Project/Action and alternatives and have been removed from further consideration in this chapter.

VERNAL POOLS

Surface-ponding vernal pools found in the study area would not depend upon groundwater to maintain pool levels (Williamson *et al.* 2005), but instead are recharged by direct precipitation and surface water (e.g., agricultural) flows. As previously outlined for the seasonally flooded agricultural lands, and in Section 11.1.2.1, implementation of the Proposed Project/Action or an alternative will not influence the quantity or seasonality of waters conveyed through ditches and canals, and applied to agricultural fields. Therefore, vernal pool communities, and associated terrestrial resources, will not be affected by the Proposed Project/Action and alternatives and have been removed from further consideration in this chapter.

SALINE EMERGENT WETLANDS

Within the study area, saline emergent wetlands are present only within the southern portions of the Delta. Large changes in freshwater inflow to the Delta associated with implementation of the Proposed Project/Action or an alternative would impact the saline emergent wetland communities in the Delta. However, the Proposed Project/Action and alternatives would minimally alter freshwater inflow to the Delta compared to the CEQA Existing Condition. Additionally, the Proposed Project/Action and alternatives would maintain freshwater inflow to the Delta within the range of inflows that occurred during recent years. As such, no impacts on saline emergent wetlands are expected to occur with implementation of the Proposed Project/Action or an alternative. Therefore, potential effects on saline emergent wetlands, and associated terrestrial resources, are removed from further consideration.

ADDITIONAL COMMUNITIES

Several upland communities are removed from further consideration in this chapter because the root zone of the community exists above any project-induced groundwater, riverine, or reservoir level change. These vegetative communities include orchards and vineyards, foothill pine-oak woodland, blue oak woodland, non-native grassland, mixed conifer, montane hardwood, chaparral, oak woodland, savanna, scrub, grasslands, and ruderal (non-native and weedy) plant communities. Although the root zone of black willow riparian habitat is hydraulically connected to groundwater, it is only located along the banks of streams entering San Luis Reservoir. As such, these communities would not be affected by groundwater pumping activities or Delta pumping activities associated with CVP/SWP operations. Therefore, the black willow riparian vegetative community also is removed from further detailed analysis.

11.1.1.3 *Special-status Plant and Wildlife Species Potentially Affected by the Proposed Project/Action and Alternatives*

Special-status species considered in this chapter include those plant and animal species that are included in one of the following categories:

- Federally listed as threatened or endangered
- Proposed to be federally listed as threatened or endangered
- Federally listed as a candidate to become a proposed species
- Federally listed as a species of concern
- Species of local concern (designated by the Sacramento USFWS office)
- State listed as threatened or endangered
- State listed as a species of special concern
- Listed as rare under the California Native Plant Protection Act
- Fully protected species under California Fish and Game Code
- Specified bird under California Fish and Game Code
- Plant species listed by the California Native Plant Society (CNPS)

Special-status species lists for the project study area were generated by:

- Requesting the USFWS to provide a list of special-status species that are known to occur or have the potential to occur within the study area, and special-status species that may be indirectly affected by project actions (the request focused on the USGS topographical quadrangles in which effects of the Proposed Project/Action and alternatives could occur);
- Querying the CNDDB and CNPS to determine special-status species known to occur within the project study area; and
- Reviewing the range, distribution, and habitat associations for all species listed under CESA.

The list of species found with the project study area was then further refined to include only those species associated with habitat that could potentially be impacted by the Proposed Project/Action and alternatives. Communities that could potentially be impacted include: (1) freshwater emergent wetland; (2) valley foothill riparian forest; (3) great valley cottonwood riparian forest; (4) great valley oak riparian forest; and (5) the early successional riparian woodland associated with San Luis Reservoir. The resulting list of special-status species associated with communities potentially affected by the Proposed Project/Action and alternatives can be found in **Table 11-1.** In addition, CNDDB queries of the appropriate quads identified known occurrences of special-status species within the study area, as shown in **Table 11-2**. A description of each special-status species, including life history and habitat distribution information, associated with these habitats is provided below.

Table 11-1. Special-status Plant and Wildlife Species Potentially Affected by the Proposed Project/Action and Alternatives

Common Name	Scientific Name	Status			Habitat Associations	Notes
		Federal	State	Other		
American white pelican	*Pelecanus erythrorhynchos*	-	CSC	CAL	FAL, FEW, SEW	Nests on lakes and reservoirs throughout California. Forages within lakes, rivers, reservoirs, and larger farm ponds.
American peregrine falcon	*Falco peregrinus anatum*	D	CE/FP	-	All habitat types	Nests near water.
Bald eagle	*Haliaeetus leucocephalus*	T	CE	CAL	FAL, FEW, SEW, FRF, CRF, ORF	Primary nesting near reservoirs; rivers utilized for foraging
Bank swallow	*Riparia riparia*	-	CT	-	FRF, CRF, ORF	Found in sandy vertical bluffs or riverbanks
Black-crowned night heron	*Nycticorax nycticorax*	-	-	CAL	FAL, FEW, SEW, FRF, CRF, ORF	Common year-round resident of the Sacramento Valley.
Black tern	*Chlidonias niger*	-	CSC	CAL	FAL, FEW	Spring and summer visitor to fresh emergent wetlands.
California black rail	*Laterallus jamaicensis coturniculus*	-	CT/FP	CAL	FAL, FEW, SEW	Inhabits saltwater, brackish, and freshwater marshes.
California red-legged frog (critical habitat)	*Rana aurora draytonii*	T	CSC	CAL	FAL, FEW, SEW, FRF, CRF, ORF	Primarily uses quiet pools of streams, ponds, and marshes containing emergent vegetation.
Columbian watermeal	*Wolffia brasiliensis*	-	-	2	FAL, FEW	Inhabits shallow freshwater marshes.
Cooper's hawk	*Accipiter cooperii*	-	CSC	-	FAL, OAV, FEW, FRF, CRF, ORF, POW, BOW, NNG	Nesting and foraging typically occur near open water or riparian vegetation.
Double-crested cormorant	*Phalacrocorax auritus*	-	CSC	-	FAL, FEW, SEW, FRF, CRF, ORF	Forages within reservoirs, lakes, and rivers.
Eel-grass pondweed	*Potamogeton zosteriformis*	-	-	2	FAL, FEW	Inhabits marsh and pond margins of the Central Valley.
Four-angled spikerush	*Eleocharis quadrangulata*	-	-	2	FAL, FEW	Inhabits marsh and pond margins of the Central Valley.
Fox sedge	*Carex vulpinoidea*	-	-	2	FAL, FEW, FRF, CRF, ORF	Uncommon to Northern California wet places.
Great blue heron	*Ardea herodias*	-	-	CAL	FAL, FEW, SEW, FRF, CRF, ORF	Typically utilizes slow moving areas of rivers, lake edges, marshes, saltwater sea coasts and swamps.
Great egret	*Ardea alba*	-	SB	CAL	FAL, FEW, SEW, FRF, CRF, ORF	Forages within marshes, lake margins, rivers, and streams.
Greater sandhill crane	*Grus canadensis tabida*	-	CT/FP	-	FAL, FEW	Found in wet meadows interspersed with emergent marsh; nests in open habitats.
Long-eared owl	*Asio otus*	-	CSC	-	FRF, CRF, ORF, POW, BOW	Uncommon winter visitor to the Central Valley. Nests in riparian areas.
Northern California black walnut	*Juglans hindsii*	-	-	1B/CAL	FRF, CRF, ORF	Found in riparian forests.
Northern harrier	*Circus cyaneus*	-	CSC	-	FAL, FEW, SEW, NNG	Nests in wetland and riparian areas.
Northwestern pond turtle	*Emys (=Clemmys) marmorata marmorata*	SC	CSC	-	FAL, FEW	Generally found in ponds and small lakes with abundant vegetation, may be seen in marshes, slow moving streams and reservoirs.
Osprey	*Pandion haliaetus*	-	CSC/SB	-	FEW, FRF, CRF, ORF	Requires open, clear waters for foraging.
Red-anthered rush	*Juncus marginatus var. marginatus*	-	-	2	FAL, FEW	Found in swampy places less than 3,281 feet msl.

Table 11.1 (continued)

Common Name	Scientific Name	Status			Habitat Associations	Notes
Ringtail	*Bassariscus astutus*	-	FP	-	FRF, CRF, ORF, POW, BOW, NNG, MIC, MOH, CHA	Occurs within riparian areas of Northern California and the Sierra Nevada foothills.
Rose-mallow	*Hibiscus lasiocarpus*	-	-	2	FAL, FEW	Found in wet banks and marshes of the Central Valley less than 131 feet msl.
Sanford's arrowhead	*Sagittaria sanfordii*	-	-	1B/CAL	FAL, FEW, SEW	When found, found in slow moving water.
Silky cryptantha	*Cryptantha crinita*	-	-	1B	FEW	Found in sandy stream banks and gravel bars of Cascade Range.
Snowy egret	*Egretta thula*	-	SB	CAL	FAL, FEW, SEW, FRF, CRF, ORF	Forages within emergent wetlands, ponds, rivers, lakes, irrigation ditches, and areas of saturated soil, including rice fields.
Swainson's hawk	*Buteo swainsoni*	-	CT	-	FAL, FEW, FRF, CRF, ORF, POW, BOW, NNG	Nests primarily in riparian forests adjacent to grasslands suitable for foraging.
Tri-colored blackbird	*Agelaius tricolor*				FEW, FRF, CRF, ORF	Requires open water, protected nesting substrate, and foraging area with insect prey within a few kilometers of colony.
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	T	-	CAL	FRF, CRF, ORF	Exclusively inhabits elderberry shrubs; often found in riparian forests
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	C	CE	-	OAV, FRF, CRF, ORF	Breeds primarily in mature cottonwoods and willows
White-faced ibis	*Plegadis chihi*	-	CSC	CAL	FAL, FEW	Nests and feeds in riparian areas.
White-tailed kite	*Elanus leucurus*	SC	FP	-	FAL, NNG, FEW, FRF, CRF, ORF	Some foraging within wetland and riparian areas.
Yellow warbler	*Dendroica petechia brewsteri*	-	CSC	-	FRF, CRF, ORF, POW, BOW	Nests and feeds in riparian areas.
Yellow-breasted chat	*Icteria virens*	-	CSC	-	FEW, FRF, CRF, ORF	Uncommon summer resident in valley foothill riparian in the foothills of the Sierra Nevada
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	-	S3S4	-	FEW	Nests and feeds in wetland areas.
Yuma myotis bat	*Myotis yumanensis*	SC	-	CAL	OAV, FRF, CRF, ORF, POW, BOW	Species range includes San Luis Reservoir. Distribution is closely tied to bodies of water.

Vegetative Community Definitions

BOW	Blue oak woodland	**N/A**	Species does not occur within one of the primary vegetative communities found within the study area
CHA	Chaparral	**NNG**	Non-native grassland
CRF	Great valley cottonwood riparian forest	**OAV**	Orchards and vineyards
FAL	Seasonally flooded agricultural lands	**ORF**	Great valley oak riparian forest
FEW	Freshwater emergent wetlands	**POW**	Foothill pine-oak woodland
FRF	Valley foothill riparian forest	**SEW**	Saline emergent wetlands
MIC	Mixed conifer	**VEP**	Vernal pools
MOH	Montane hardwood		

Table 11.1 (continued)

Federal Status		State Status		Other Status	
E	Listed as endangered under ESA	**CE**	Listed as endangered under CESA	**1A**	CNPS List 1A
T	Listed as threatened under ESA	**CT**	Listed as threatened under CESA	**1B**	CNPS List 1B
P	Officially proposed for listing as either threatened or endangered under ESA	**CSC**	Species of special concern under CESA	**2**	CNPS List 2
C	Candidate - Candidate to become a proposed species under ESA	**R**	Listed as rare under California Native Plant Protection Act	**3**	CNPS List 3
D	Delisted - Monitoring to continue for 5 years following delisting	**FP**	Fully protected species under California Fish and Game Code	**CAL**	Other species of concern identified by CALFED
SC	Species of concern under ESA	**SB**	Specified bird under California Fish and Game Code		
SLC	Species of local concern - Other species of concern to the Sacramento USFWS Office				

Table 11-2. CNDDB List of Special-status Species Occurrences of the Project Study Area

Species Name	Number of Occurrences	Quadrangle(s)
Swainson's Hawk (*Buteo swainsoni*)	5	Nicolaus
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	4	Nicolaus, Yuba City
Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)	19	Gridley, Sheridan, Nicolaus, Honut, Olivehurst, Wheatland, Browns Valley, Loma Rica
Bald Eagle (*Haliaeetus leucocephalus*)	3	Camptonville, Forbestown, Oregon House
California Black Rail (*Laterallus jamaicensis coturniculus*)	2	Camp Far West
California Red-legged Frog (*Rana aurora draytonii*)	1	Challenge
Bank Swallow (*Riparia riparia*)	24	Olivehurst, Nicolaus, Gridley, Honcut, Yuba City, Sutter, Verona

It should be noted that not all of the habitat types in which species presented in Table 11-1 inhabit could be impacted by implementation of the Proposed Project/Action or an alternative. For example, ringtails utilize multiple habitat types including riparian habitats, which could potentially be impacted. However the species also utilizes habitat types such as non-native grassland and chaparral that would not likely be impacted by implementation of the Proposed Project/Action or an alternative. Additionally, not all of the species listed in Table 11-1 occur in all regions of the study area. For example potential impacts on riparian habitat in the Yuba Region would not impact the Yuma myotis bat, which only is known to inhabit the area near San Luis Reservoir within the study area.

California Wildlife Notes prepared to support California's Wildlife Habitat Relationship System (CDFG 2005) and the CDFG's Habitat Conservation Planning Branch's species accounts (CDFG Website 2006a) were the primary sources for the following wildlife species accounts, while *"The Jepson Manual"* (Hickman 1993) was the primary source of plant species life history information.

AMERICAN WHITE PELICAN

Historically, the American white pelican (*Pelecanus erythrorhynchos*) nested on large lakes over the entire length of California including the lower Sacramento Valley. Currently no remaining nesting colonies in California exist except along the Oregon border. Specifically, a population of 1,700 to approximately 6,000 individuals breeds in the Klamath Basin refuges, with Clear Lake National Wildlife Refuge (NWR) supporting the majority of birds (CDFG Website 2006a). American white pelicans generally are common to abundant on nesting grounds during April through August (sometimes during March to September). From August to December, the species is common on salt ponds of San Francisco Bay and on large lakes and estuaries in the Central Valley and on the coastal slope from Sonoma County south (CDFG Website 2006a). Most of the breeding population vacates northeastern California from October to March. Individuals rest during the day and roost at night along the edge of water, on beaches, sandbars, or on old driftwood (CDFG Website 2006a).

American white pelicans are circadian feeders during the breeding season, but are less active in middle of day. During winter, individuals are diurnal feeders. In tidal areas, pelicans usually feed on the rising tide. Feeding occurs in water of various depths by diving for prey items from the surface and scooping them up in the sub-mandibular pouch. In shallow water, small groups sometimes cooperate to drive fish closer to shore, where they are easily caught. The species preys almost entirely on fish, but occasionally on amphibians and crustaceans (CDFG Website 2006a).

During the breeding season individuals may commute as much as 184 miles each way from breeding grounds to foraging areas. Nest-sites must be flat or gently sloping, lacking shrubs or other obstructions that would impede taking flight, free of human disturbance, and usually contain loose earth suitable for nest-mounds. American white pelicans are monogamous, colonial nesters that congregate in groups of a few to several hundred pairs. Nest-building typically begins in March or April with egg-laying occurring during April. Altricial young are fed by both parents, and leave the nest at three to four weeks of age.

AMERICAN PEREGRINE FALCON

The peregrine falcon (*Falco peregrinus*) is a very uncommon breeding California resident and an uncommon migrant (CDFG Website 2006a). Active nesting sites are known along the coast north of Santa Barbara, in the Sierra Nevada, and in other mountains of northern California. During winter individuals can be found inland throughout the Central Valley. Migration occurs along the coast and in the western Sierra Nevada during spring and fall. Riparian areas and coastal and inland wetlands are important habitats year-round, especially during non-breeding seasons.

Peregrine falcons breed mostly in woodland, forest, and coastal habitats during early March to late August. Breeding occurs near wetlands, lakes, rivers, or other water on high cliffs, banks, dunes, mounds. Typically, nests are a scrape on a depression or ledge in an open site. In one Utah study, nests averaged 3.3 miles from the nearest foraging marsh, and 7.6 miles from the nearest marsh over 320 acres in area (CDFG Website 2006a). In the Rocky Mountains, home range for the peregrine falcon included an area with a radius up to 14 miles from cliff nests. In Sonoma County, the average home range size was approximately 125 square miles), but home range size fluctuated and was dependent on prey availability.

Peregrine falcons usually breed and feed near water (CDFG Website 2006a). Prey species typically consist of a variety of birds up to the size of a duck, but individuals occasionally prey on mammals, insects, and fish.

BALD EAGLE

The bald eagle (*Haliaeetus leuocephalus*) is the second largest North American bird of prey with an average wingspan of seven feet. Adults have a distinctive white head and white tail offset against a dark brown body and wings. Females are approximately 25 percent larger than males, but the sexes are otherwise similar in appearance.

Bald eagles currently nest throughout the western United States, including California. Historically, bald eagles nested throughout California near seacoasts, major rivers, and lakes. As of 1999, 188 known nesting territories existed in 58 California counties (up from 28 in 1978) (CDFG Website 2006a). Hundreds of additional bald eagles migrate into California during winter months from nesting territories throughout Washington, Oregon, Alaska, and Canada.

Nesting habitat is described as large, old-growth live trees with open branchwork, especially ponderosa pine (CDFG Website 2006b). A survey conducted during 1979 indicated that, of 95 bald eagle nest sites surveyed in northern California, 87 percent were in dominant or co-dominant ponderosa pine or sugar pine (Lehman 1979). Associated stands generally were open (less than 40 percent canopy cover) and within one mile of a water body. Approximately one third of the nest sites were within 0.1 mile of a water body and 85 percent of the nests had an unobstructed view of the water body. Seventy percent of the nests were associated with reservoirs.

Nest trees typically are relatively large with an average diameter at breast height in California and arid portions of Oregon reportedly ranging from 41 inches to 46 inches (Anthony *et al.* 1982; Lehman *et al.* 1980). In addition to requiring stands with large trees for actual nest construction, nesting eagles also require the presence of snags and dead-top trees with large lateral limbs for perching, and territory defense (USFWS 1986).

Throughout most of California, the bald eagle breeding season extends from approximately January through August (CDFG Website 2004). Females generally lay between one and three eggs. The most common clutch size, however, reportedly is two eggs (Stalmaster 1987). Females and males incubate the eggs with incubation generally lasting approximately 35 days. Both parents feed the eaglet prior to fledging, which generally occurs approximately 11 weeks to 12 weeks after hatching. Fledglings disperse from the nest area as early as several weeks after fledging.

Bald eagle nesting territories vary greatly in size. Nesting territory sizes estimates include: 0.06 square miles in eastern Canada (Gittens 1968); 0.09 square mile in Alaska (Hensel and Troyer 1964); 0.42 square mile in Minnesota (Mahaffy 1981); and 0.60 square mile in Michigan (Mattsson 1974). The most common territory size reportedly ranges from 0.4 to 0.8 square mile (Stalmaster 1987). Bald eagles typically do not build a nest within the nesting territory of another nesting eagle pair. Territory shapes range from circular, oval, to almost linear, depending on the configuration of suitable habitat, including trees and watercourses. Lake Britton in Shasta County has one of the highest known nesting densities with an average distance of 1.5 miles between nest sites (Detrich 1980).

Wintering eagles require diurnal perches and nocturnal roosts. Perches typically are relatively tall and are near a food source, usually within 164 feet of water, while roosts can be many miles from foraging areas. Bald eagles may use natural or anthropogenic perches (Stalmaster 1987). Roost sites typically provide shelter from cold, wind, and precipitation, and may be used communally or by individual eagles. Preferred roost trees tend to be taller than the surrounding forest or landscape. Bald eagles often roost in conifer stands, but may use cottonwoods and willows for night roosting in some areas (Isaacs and Anthony 1983). In northern California, several nesting pairs studied by PG&E were found to be year-round residents that typically roosted during the winter within several miles of the nest sites (USFWS 1986). Communal roosts can support many eagles and are typically near a rich food source (concentrated waterfowl or fish) (USFWS 1986).

Bald eagles are opportunistic foragers and their diet varies across their range based on prey species availability. Eagles reportedly prefer fish, but will eat a great variety of mammals, amphibians, crustaceans, and birds, including many species of waterfowl. Foraging habitat for bald eagles includes lakes, rivers, oceans, shorelines, and occasionally, deserts, grasslands, and alpine (Stalmaster 1987). In northern California, most bald eagles nesting near reservoirs foraged on fish (PG&E 2002). Jackman *et. al*. (1999) reported that inland nesting bald eagles prey on native and introduced fishes, including brown bullhead (*Ameiurus nebulosus*), Sacramento sucker (*Catostomus occidentalis*), carp (*Cyprinus carpio*), and tui chub (*Gila bicolor*). These authors also reported that mallards (*Anas platyrhynchos*) and coots (*Fulica americana*) were prey items in some areas. Bald eagles also commonly feed on fish carrion, including salmon carcasses, in shallow water, on river or lake shores, or downstream of hydroelectric powerhouse tailraces. Large concentrations of waterfowl during the migration or winter can serve as a rich food source for bald eagles. Mammalian carrion (e.g., voles, ground squirrels, rabbits, deer, and livestock) can provide an alternate source of food for eagles in some areas (USFWS 1986).

BANK SWALLOW

Bank swallows (*Riparia riparia*) are the smallest of the North American swallows, with an average body length of about 4.75 inches. Bank swallows are distinguished from other swallows by their distinct brown breast band contrasting with white underparts. The species nests in colonies and creates nests by burrowing into vertical banks consisting of fine-textured soils. Bank swallows breed in California from April to August and spend winter months in South America. Currently, bank swallows are locally common only in restricted portions of California where sandy, vertical bluffs or riverbanks are available for the birds to dig their burrows and nest in colonies. Colonies in California range in size from 10 to 1,500 nesting pairs, although most colonies have 100 to 200 nesting pairs (CDFG Website 2006a). Nests are almost always near water, and lined with grasses and other plant material and feathers. Burrows are 1 inch to 2.2 inches wide and up to 54 inches deep. A small chamber at the end of the burrow contains the nest (CDFG Website 2006a). It is estimated that the range of bank swallows in California has been reduced by 50 percent since 1900 (CDFG Website 2006a).

It has been estimated that up to 75 percent of the current bank swallow breeding population in California occurs along banks of the Sacramento and Feather rivers in the northern Central Valley. Approximately 50 to 60 colonies remain along the middle Sacramento River and approximately 15 to 25 colonies nest along the lower Feather River. Other colonies persist along the central coast from Monterey to San Mateo counties, and northeastern California in Shasta, Siskiyou, Lassen, Plumas, and Modoc counties (CDFG Website 2006a).

Recent survey information indicates a continuing decline in bank swallow populations on the Sacramento River. An estimated population of 13,170 pairs of bank swallows nested in Sacramento River habitats during 1986. During 1997, the breeding population had declined to approximately 5,770 pairs, which represents a decline of approximately 61 percent. Additionally, the average colony size has declined from 410 burrows to approximately 250 burrows between 1986 and 1997. During 1998 the population reached its lowest level of 4,990 pairs and then rebounded during 1999 to 8,210 pairs.

Bank Swallows forage by hawking insects during long, gliding flights. They feed predominantly over open riparian areas, but also over brushland, grassland, wetlands, water, and cropland. They also feed on a wide variety of aerial and terrestrial soft-bodied insects including flies, bees, and beetles (CDFG Website 2006b).

BLACK-CROWNED NIGHT HERON

Black-crowned night-herons (*Nycticorax nycticorax*) are relatively common, year-long residents in lowlands and foothills throughout most of California (CDFG Website 2006a).

Black-crowned night herons typically breed from February to July, but breed from April to August in northeastern California. Nests are constructed in densely foliaged trees, dense, fresh or brackish emergent wetlands, or dense shrubbery or vine tangles near aquatic or emergent wetland feeding areas. Nests are built of twigs and/or marsh plants.

A home range from North Carolina is reported by CDFG (2006b) in which the herons foraged up to 5 miles from their nesting area. The reported black-crowned night heron diet is highly variable and consists of fish, crustaceans, aquatic insects and other invertebrates, amphibians, reptiles, small mammals, and rarely young birds (CDFG Website 2006b). Prey is found along the margins of lacustrine, large riverine, and fresh and saline emergent habitats and, rarely, on kelp beds in marine subtidal habitats.

BLACK TERN

Black terns (*Chlidonias niger*) historically were common spring and summer visitors to fresh emergent wetlands in California. However, population estimates reportedly have declined throughout the range, especially in the Central Valley (CDFG Website 2006a). They currently migrate through and breed on wetlands of the northeastern plateau area of the Central Valley; however, are extirpated from some historic nesting localities, such as Lake Tahoe (CDFG Website 2006b). Black terns are restricted to freshwater habitats while breeding. However, they can be fairly common on bays, salt ponds, river mouths, and pelagic waters during spring and fall migration (CDFG Website 2006b). During 1997, a survey of northeastern California counties indicated that an estimated 1,940 pairs of black terns were breeding at 60 sites. Approximately 59 percent of that regional black tern population was concentrated at 10 sites and approximately 70 percent of the regional population was located in Modoc County. Most marshes where black terns bred were dominated by low freshwater emergent wetland species including spikerush *(Eleocharis* spp.) and *Juncus* spp (CDFG 1998).

The breeding season extends from May through late August with a peak during June and July. The species is a loosely colonial nester with individuals typically laying three eggs in clutch (range two to four) (CDFG Website 2006b). Black tern nests consist of a loose mass of dead plant stems, anchored to standing vegetation or floating on a still or slow moving water surface. Nesting sometimes occurs on dry ground where a hollow scrape lined with fine plant matter is used. Nesting individuals also sometimes take over abandoned muskrat dens, or coot or grebe nests (CDFG Website 2006b).

Black terns forage by hovering above wet meadows and fresh emergent wetlands. Typical food sources include grasshoppers, dragonflies, moths, flies, beetles, crickets, and other insects (CDFG Website 2006b). Foraging individuals typically catch insects in the air and on water and vegetation surfaces. Recently plowed croplands also serve as forage sites because plowing can cause disturbed adult and larval insect activity, which provides a food source for foraging birds, including black terns.

Wintering occurs off the coast of northwestern South America. Spring migration takes place during April and May, and fall migration extends from late June through September, but individuals have been reported in California during all months or the year (CDFG Website 2006b).

CALIFORNIA BLACK RAIL

The California black rail (*Lateralus jamaicensis coturniculus*) is small, blackish in color with a small black bill, a back speckled with white, and a nape of deep chestnut brown (CDFG Website 2006a) and inhabits saltwater, brackish, and freshwater marshes. Historically, California black rails were reported from the San Francisco Bay and the Delta south along the coast to northern Baja California, in the San Bernardino-Riverside area, at the Salton Sea, and along the lower Colorado River north of Yuma in California and Arizona (CDFG Website 2006b). During 1994, a population of California black rails was found at the University of California's Sierra Field Station in Yuba County (CDFG Website 2006b). A survey conducted during 1997 through 1999 found several previously unknown sites occupied by California black rails in Butte, Yuba, and Nevada counties.

California black rails are carnivorous and eat insects, and other arthropods from the surface of mudflats and vegetation associated with marshes (CDFG Website 2006a). They nest concealed in dense vegetation near the upper limits of tidal flooding from March to June. Clutch size varies, but reportedly averages six eggs (CDFG Website 2006b).

CALIFORNIA RED-LEGGED FROG

The California red-legged frog (*Rana aurora draytonii*) is the largest frog native and endemic to California. Adults are reported up to 5.4 inches in length, and females generally are larger than males (USFWS 2002). There is a rusty-red color on its belly and underside of its hind legs.

Historically, California red-legged frogs occupied suitable habitat from coastal Marin County, near Point Reyes National Seashore, to northwestern Baja California. From the coast, California red-legged frog habitat extended inland to near Redding in Shasta County. Historic records show that California red-legged frogs occurred below 5,200 feet in elevation (USFWS 2002) in 46 counties (Jennings and Hayes 1985). Currently, California red-legged frogs reportedly are known to occur in isolated areas in the Sierra Nevada, the northern California coast, and northern Transverse Range, and are nearly extinct in the Transverse Range and Peninsular ranges (USFWS 2002). The species is now common only along the central coast, in the San Francisco Bay area, and in Baja California. Current records indicate California red-legged frogs are found below 3,500 feet msl (USFWS 2002) and are currently considered to be extirpated from 24 of the 46 counties, and about 70 percent of the area of their known historic range (Jennings and Hayes 1985; USFWS 2002).

California red-legged frogs are found in a variety of permanent aquatic habitats, including quiet pools of streams, ponds, marshes, and riparian habitats (USFWS 2002). Essential habitat elements include permanent aquatic habitat including emergent vegetation such as cattails, sedges, and bulrushes, with connectivity to uplands (66 FR 14626 (March 13, 2001)). California red-legged frogs show variations in habitat use, either using a pond suitable for all life stages, or using multiple habitat types to complete life stages. As such, dispersal habitat also is an important habitat element (66 FR 14626 (March 13, 2001)). Populations are thought to best persist where multiple breeding areas exist within habitat that can be used for dispersal (USFWS 2002).

Adults have been shown to move over upland habitats for distances of more than one mile during wet seasons. Monitored individuals in Santa Cruz County moved more than two miles without apparent regard to topography, vegetation type, or riparian corridors (USFWS 2002). During dry periods, however, adults are rarely found far from water and commonly take refuge during in rodent holes or leaf litter in riparian habitats.

California red-legged frogs breed from November through March (Storer 1925) in lowland streams and wetlands, including livestock ponds (Stebbins 1985). Water impoundments also are known to support breeding California red-legged frogs (66 FR 14626 (March 13, 2001)). Hayes and Jennings (1988) reported that California red-legged frogs breed in a variety of aquatic conditions, including creeks, ponds, marshes, and lagoons. An important factor influencing the suitability of aquatic breeding sites is the absence of introduced aquatic predators (66 FR 14626 (March 13, 2001)). Breeding adults generally are associated with ponds and streams where water is over two feet deep and slow moving with dense emergent and/or riparian vegetation. However, adults have been observed in aquatic conditions where such vegetation conditions were not present, such as in tributary streams with pools less than 18 inches in depth, and during summer conditions in pools that averaged 12 inches in depth (USFWS 2002). Hayes and Jennings (1988) also reported that California red-legged frogs were most frequently detected at sites influenced by a small drainage area with a low local gradient, and in streams having a low stream order.

Male California red-legged frogs reach sexual maturity in two years while females require three years (Jennings and Hayes 1985). Egg masses typically have 2,000 to 5,000 eggs and are attached to emergent vegetation (brace) or a similar suitable feature. Egg masses typically are attached to emergent vegetation such that they float at or just below the water surface (Storer 1925). Eggs hatch within 14 days, depending on water temperature. Tadpoles generally metamorphose into adults within 75 to 120 days, although overwintering of tadpoles has been reported (USFWS 2002).

Larval California red-legged frogs are thought to be grazers of algae (USFWS 2002). Adults forage within the riparian habitat and from the water surface, and have a varied diet that includes both invertebrates and vertebrates such as Pacific chorus frogs (*Pseudacris regilla*) and California mice (*Peromyscus californicus*). Invertebrates comprise the majority of dietary items. however, vertebrates comprise more than half of the dietary mass (Hayes and Tennant 1985).

COLUMBIAN WATERMEAL

Little is known about the specific locations of Columbian watermeal (*Wolffia brasiliensis*). However, this species is an uncommon perennial floating aquatic plant whose range includes the ponds and ponded areas within the marshes and wet areas of the Sacramento River at elevations less than 328 feet msl (Hickman 1993).

COOPER’S HAWK

Cooper's hawk (*Accipiter cooperii*) breeding populations reportedly have declined throughout California. However, wintering Cooper’s hawks are more common in California than breeding individuals. These populations, after a steady decline from the early 1950s through the mid-1960s, reportedly were stabilizing during the late 1960s but at a level much reduced from the early 1950s (CDFG Website 2006b).

Cooper’s hawks breed primarily in the southern Sierra Nevada foothills, Owens Valley, and other local areas in southern California (CDFG Website 2006a). Primary nesting habitat consists of dense stands of live oak, riparian deciduous or other forest habitats near water (CDFG Website 2006b). They are seldom found in areas without dense tree stands, or patchy woodland habitat (CDFG Website 2006b). Cooper's hawks nest in the crotches of deciduous trees approximately 10 feet to 80 feet above the ground (CDFG Website 2006b). Nests typically are stick platforms lined with bark. Individuals commonly nest in second-growth conifer stands, or in deciduous riparian areas, usually near streams (CDFG Website 2006b).

Cooper's hawks breed from March through August with peak breeding activity occurring from May through July (CDFG Website 2006b). Nesting and foraging usually occur near open water or riparian vegetation. Winter migration commences in the northern states during late August to November, with a peak during September. Wintering habitat is similar to nesting habitat, but open grassland areas reportedly are used more frequently for foraging than during the nesting season. Northward migration occurs from late February to early April (CDFG Website 2006a).

Males typically perform most of the nest building activities. A typical clutch size is four to five eggs, with clutches of three and six rarely observed (CDFG Website 2006a). Females typically incubate eggs. During the pre-fledging period males forage for the nestlings and the female parent, while both parents feed the young for up to four weeks after fledging. Fledging typically occurs approximately one month after hatching. Fledglings remain dependent on their parents until they are approximately eight weeks of age and have learned to forage on their own (CDFG Website 2006b).

Cooper's hawks eat a wide variety of foods, but primarily consume other birds. Small mammals, reptiles, and amphibians comprise the remainder of the diet (CDFG Website 2006a). Foraging typically occurs in broken woodland and along woodland habitat edges. Cooper's hawks also have been reported to use cover to hide, attack, and approach prey (CDFG Website 2006a).

DOUBLE-CRESTED CORMORANT

Double-crested cormorants (*Phalacrocorax auritus*) formerly bred on coastal cliffs and offshore islands along the coast from Marin County south to La Jolla, San Diego County, and in the interior in northeastern California, the Sacramento Valley, the San Joaquin Valley, and the Salton Sea. Recent surveys identified breeding populations from Marin County north to the Oregon border. Currently, no breeding populations are known from the Sacramento and San Joaquin valleys and the Salton Sea (CDFG Website 2006a). Double-crested cormorants are year-round residents along the entire coast of California and on inland lakes, in fresh, salt and estuarine waters. During August to May they are fairly common to locally very common along the coast and in estuaries and salt ponds, and are fairly common in lacustrine and riverine habitats of the Central Valley and coastal slope lowlands. Individuals primarily are active during the day, but migrate during both day and night. They are summer residents of the mountains and northeastern plateau, and are absent from approximately November to March (CDFG Website 2006a).

Individuals rest during the daytime and roost overnight beside water on offshore rocks, islands, steep cliffs, dead branches of trees, wharfs, jetties, or transmission lines. Perching sites must be barren of vegetation. Individuals visit perches periodically during the in day to dry their plumage. However, cormorants sometimes rest or sleep on water during the day. Considerable lengths of water or elevated perches are required for take-off (CDFG Website 2006a).

Double-crested cormorants feed mainly on fish but also consume crustaceans and amphibians. Feeding occurs as individuals dive from the water surface and pursue prey underwater, typically in water less than 30 feet deep with rocky or gravel substrates. Sometimes individuals feed cooperatively in flocks of up to 600, often with pelicans (CDFG Website 2006b).

The species requires undisturbed nest-sites beside water. Wide rock ledges on cliffs; rugged slopes, and live or dead trees are typical nesting sites. Suitable nest sites must be within 5 to 10 miles of a dependable food supply (CDFG Website 2006b). Breeding occurs mostly from April to July or August. Most egg-laying occurs during April to June. Monogamous individuals nest in colonies of a few pairs to hundreds of pairs. Clutch size ranges from two to seven, but usually three to four eggs are laid. Altricial young are tended by both parents (CDFG Website 2006b).

EEL-GRASS PONDWEED

Eel-grass pondweed (*Potamogeton zosteriformis*) is an uncommon annual aquatic herb whose range includes the ponds, lakes and stream margins of the Central Valley at elevations less than approximately 4,270 feet msl (Hickman 1993).

FOUR-ANGLED SPIKERUSH

Four-angled spikerush (*eleocharis quadrangulata*) is a perennial herbaceous plant found in the marshes and wet areas of the Central Valley at elevations less than approximately 1,640 feet msl (Hickman 1993).

FOX SEDGE

Fox sedge (*Carex vulpinoidea*) is a perennial herbaceous plant found in wet areas of the southwest Klamath Ranges, north High Cascade Range, and north Sacramento Valley at elevations less than approximately 3,940 feet msl (Hickman 1993).

GREAT BLUE HERON

Great blue herons (*Ardea herodias*) are fairly common year-round throughout most of California, in shallow estuaries, and fresh and saline emergent wetlands. Individuals are less common along riverine and rocky marine shores, in croplands, pastures, and in mountains above foothills. They are common from July to October in salt ponds where fish are numerous and are locally common near rookeries from February to June or July. Few rookeries are found in southern California, but many are scattered throughout northern California. However, knowledge of rookery locations is incomplete. Individuals perch and roost in secluded tall trees. Great blue herons are active year-round, feeding both night and day. However, the majority of activity occurs during dawn and dusk (CDFG Website 2006a).

Nearly 75 percent of great blue heron diets consist of fish, but small rodents, amphibians, snakes, lizards, insects, crustaceans, and occasionally small birds also are consumed. During feeding, individuals stand motionless, or walk slowly, when searching for prey in shallow water (less than 12 inches) or, less commonly, in open fields (CDFG Website 2006b).

Great blue herons usually nest in colonies in tops of secluded large snags or live trees. Nesting rarely occurs on rock ledges, sea cliffs, mats of tules, shrubs, or on the ground. Secluded groves of tall trees near shallow-water feeding areas are typical. However, feeding areas may be up to 10 miles from nest sites. Individuals usually arrive on breeding grounds during February.

Courtship and nest-building begin shortly thereafter, and eggs are laid during late February or March. Individuals are monogamous, but often nest in colonies, sometimes with five or more pairs. Semi-altricial, downy young are cared for by both parents. In California, great blue herons often nest in mixed colonies with great egrets. During June or July, after breeding, individuals disperse from nesting colonies to outlying areas (CDFG Website 2006b).

GREAT EGRET

Great egrets (*Ardea alba*) are common year-round residents throughout California, except for high mountain and desert areas (CDFG Website 2006a). In northern California, they are common in coastal lowlands, inland valleys, and the Central Valley.

Great egrets nest and roost in large trees (CDFG Website 2006b). Nesting occurs from March to July and requires groves of trees that are relatively isolated from human activities near aquatic foraging areas. Nests are constructed of sticks and stems of marsh plants. In California, great egrets nest in large trees ranging from 10 to 80 feet tall (CDFG Website 2006b).

Great egrets may forage up to 20 miles from their nests, but typically forage relatively nearby nesting areas (CDFG Website 2006b). CDFG (2006b) cites studies in which the breeding home ranges had a 5- to 10-mile radius around nests, while winter home ranges were within the same size range centered around roosts. Unpaired individuals reportedly defended "large" territories, which gradually shrank to a mean of 43 square feet after pairing (CDFG Website 2006b).

Great egrets typically feed in shallow water and along shores of estuaries, lakes, ditches, slow-moving streams, salt ponds, mudflats, and in irrigated croplands and pastures (CDFG Website 2006b). Diets consist primarily of fish, amphibians, snakes, snails, crustaceans, insects, and small mammals.

GREATER SANDHILL CRANES

Greater sandhill cranes (*Grus canadensis tabida*) are the largest of the six subspecies of sandhill cranes. The majority of their bodies are pale gray with darker primary feathers (CDFG Website 2006b). Fledglings are similar in size to adults but can be distinguished by the rust-brown feathers on the nape of the neck. Breeding populations from north of California pass southward through the state during September and October, and return northward during March and April. Sandhill cranes migrate directly and quickly in large flocks. Courtship begins during April with peak breeding occurring during May until July. Nesting is completed by late August (CDFG Website 2006b).

Historically, greater sandhill cranes nested in eastern Siskiyou County and northeastern Shasta County southward to Honey Lake in Lassen County. Presently, greater sandhill cranes nest in Lassen, Modoc, Plumas, Shasta, Sierra, and Siskiyou counties (CDFG Website 2006b). Sandhill cranes that breed in California winter chiefly in the Central Valley.

In California, sandhill cranes establish territories in wet meadows that often are interspersed with emergent marsh habitat. Nesting primarily occurs in open habitat. However, in certain areas, greater sandhill cranes nest in areas with a dense cover of bulrush and bull-reed (CDFG Website 2006b). The last statewide breeding population study in California was conducted during 1988, and the breeding population was estimated to be 276 pairs (CDFG Website 2006b).

Favorable roost sites and an abundance of cereal grain crops characterize the Central Valley wintering grounds. Rice fields are used extensively by cranes near the Butte Sink area of Butte

County, while corn fields provide the principal food source at most other Central Valley wintering areas, particularly in the Delta near Lodi, San Joaquin County. Irrigated pastures commonly are used as resting sites throughout the wintering ground. A communal roost site consisting of an open expanse of shallow water is a key feature of wintering habitat (CDFG Website 2006b).

LONG-EARED OWL

Long-eared owls (*Asio otus*) are uncommon year-round residents throughout most of California and uncommon winter visitors to the Central Valley and Southern California deserts (CDFG Website 2006b). Long-eared owls require riparian or other thickets with small, densely canopied trees, which are required for roosting and nesting, but individuals also use live oak thickets and other dense stands of trees.

Breeding extends from early March to late July in several habitat types at varying elevations ranging from valley foothill hardwood up to ponderosa pine habitats (CDFG Website 2006b). Nests are made within old crow, magpie, hawk, heron, and squirrel nest in a variety of densely canopied trees. Nests are usually 10 to 50 feet above the ground. One Wyoming study found that long-eared owl breeding home ranges in riparian habitat varied from 83 to 262 acres, and averaged 134 acres (CDFG Website 2006b).

Long-eared owls mostly prey upon voles and other rodents, and occasionally prey on birds, including smaller owls, and other vertebrates (CDFG Website 2006b). They usually hunt in open areas, or occasionally in woodland and forested habitats.

NORTHERN CALIFORNIA BLACK WALNUT

The original distribution of Northern California black walnut (*Juglans hindsii*) is unknown (DBW Website 2001). Stands along Walnut and Lafayette creeks in Contra Costa County, near Walnut Grove in Sacramento County, and near Wooden Valley in Napa County are cited as the "native" stands of this species and are considered endangered. The species was planted as a street tree in central California and used as root stock for the early California walnut industry. It freely hybridizes with commercial varieties. California black walnut and various crosses have since become widely naturalized in riparian forests of the Great Valley and surrounding foothills.

Northern California black walnut is associated with deep alluvial soil near creeks, streams, or springs that provide summer water. It is a riparian canopy tree, often associated with Valley oak, Oregon ash, and poison oak (DBW Website 2001).

NORTHERN HARRIER

Northern Harriers (*Circus cyaneus*) occur in habitat types and elevations ranging from annual grassland up to lodgepole pine and alpine meadow habitats, as high as 10,000 feet in the Central Valley and Sierra Nevada, and up to 3,600 feet in northeastern California (CDFG Website 2006b). They frequent meadows, grasslands, open rangelands, desert sinks, fresh and saltwater emergent wetlands, but are seldom found in wooded areas. Northern harriers are permanent residents of the northeastern plateau and coastal areas and are less common residents of the Central Valley.

Breeding occurs from April to September, with peak activity occurring during June through July (CDFG Website 2006b). Nests mostly are observed in emergent wetland habitat or along the banks of rivers or lakes. However, individuals also may nest in grasslands, grain fields, or on sagebrush flats several miles from water.

CDFG (2006b) reports that breeding home ranges in Utah averaged 1,060 acres, and varied from 896 to 1280 acres. In Michigan, individuals flew 1 to 5.5 miles daily from a communal roost site to foraging areas, while daily foraging areas varied from 30 to 640 acres. Breeding home ranges averaged 1,000 acres, and varied from 243 to 1,920 acres in size (n=15). In Wisconsin, the breeding home range of one radio-tagged pair included was reported to be or 2,200 acres. In Manitoba, defended territories extended approximately 96 acres around nests (CDFG Website 2006b).

Northern harriers feed mostly on voles and other small mammals, birds, frogs, small reptiles, crustaceans, and insects (CDFG Website 2006b).

NORTHWESTERN POND TURTLE

Western pond turtles (*Clemys marmorata*) are moderately sized (4.5 to 8.5 inches), drab brown or khaki-colored, and lack prominent markings on their carapaces (CDFG Website 2006b). The belly, or plastron, typically is marked with varying degrees of dark and light markings. Some individuals have an entirely dark or an entirely light plastron. Two subspecies of western pond turtles are recognized. The northwestern pond turtle ranges from western Washington down to San Francisco Bay, and also is found in western Nevada. The southwestern pond turtle is found from San Francisco Bay southward to Baja California (Stebbins 1985).

Pond turtles generally are found in ponds and small lakes with abundant vegetation, but also have been observed in marshes, slow moving streams, reservoirs and occasionally in brackish water (CDFG Website 2006b). They are associated with permanent or nearly permanent water in a wide variety of habitat types, including irrigation ditches. The availability of basking sites is an important habitat characteristic and may include partially submerged logs, rocks, mats of floating vegetation, or open mud banks. Western pond turtles are uncommon in high gradient streams probably because water temperatures, current velocities, food resources, or any combination thereof may limit their local distribution. Hatchling and juvenile pond turtles have a specialized microhabitat consisting of shallow water (less then 12 inches deep) with emergent vegetation consisting of reeds, sedges, or cattails. Hatchlings may be subject to rapid death by desiccation if exposed to hot, dry conditions.

Breeding takes place from April to August. Females make an earthen chamber in a sunny spot, typically near the water's edge, or up to 330 feet away if the river's edge is too shady (CDFG Website 2006b). Nesting site soils are required to be at least 4 inches deep. Females lay one clutch of 3 to 11 eggs and hatchlings emerge approximately 12 weeks after oviposition. Some female pond turtles will return to the same nesting sites year-after-year (CDFG Website 2006b).

Western pond turtles are food generalists, obtaining food by foraging and scavenging. They are omnivorous and feed on pond lilies, beetles and a variety of aquatic invertebrates as well as fish, frogs, and carrion (CDFG Website 2006b).

OSPREY

Ospreys (*Pandion haliaetus*) formerly bred throughout much of California, but degradation of habitat has led to observations in relatively few areas in northern California. Specifically, relatively large populations are known immediately inland from the coast from Sonoma County northward, and in Shasta, Lassen, and Plumas counties (CDFG Website 2006b). Breeding occurs in northern California from the Cascade Ranges south to Lake Tahoe, and along the coast south to Marin County. Regular breeding sites include Shasta Lake, Eagle Lake, Lake Almanor, other inland lakes and reservoirs, and northwest river systems (CDFG Website 2006b).

Ospreys are primarily associated with large, fish-bearing waters, primarily in ponderosa pine through mixed conifer habitats. The primary food source for ospreys is fish. However, individuals also feed on mammals, birds, reptiles, amphibians, and invertebrates (CDFG Website 2006b). Ospreys require open, clear waters for foraging and utilize rivers, lakes, reservoirs, bays, estuaries, and surf zones. Bald eagles and gulls compete with ospreys for food.

Ospreys typically nest on a platform of sticks at the top of large snags, dead-topped trees, on cliffs, or on human made structures (CDFG Website 2006b). Nests may be as much as 250 feet above the ground (CDFG Website 2006b). Nests generally are located within approximately 1,300 feet from fish-producing waters, but individuals have been reported to travel up to 6 miles from nesting to foraging areas (CDFG Website 2006b).

Migration to nesting grounds occurs from mid-March to early April. Breeding occurs from arrival on the nesting grounds until September. Colonial nesting is reported to be common. Females lay one to four eggs (CDFG Website 2006b).

RED-ANTHERED RUSH

Red-anthered rush (*Juncus marginatus var. marginatus*) is a perennial herbaceous plant that grows in swampy places of the Sierra Nevada foothills at elevations up to 3,280 feet msl (Hickman 1993).

RINGTAIL

Ringtails (*Bassariscus astutus*) are widely distributed and are permanent residents in various riparian habitats and in brush stands of most forest and shrub habitats at low to middle elevations. Little information is available on the distribution and relative abundance of the species among habitats. Individuals utilize hollow trees, logs, snags, cavities in talus in rocky areas, and other recesses for cover during the day and are active during the night. Individuals typically are found within 0.6 mile of water (CDFG Website 2006b).

Ringtails primarily are carnivorous, eating mainly rodents (woodrats and mice) and rabbits. Individuals also consume substantial numbers of birds and eggs, reptiles, invertebrates, fruits, nuts, and some carrion. Foraging occurs on the ground, among rocks, and in trees. Probable ringtail predators include bobcats, raccoons, foxes, and large owls (CDFG Website 2006b).

Ringtails nest in rock recesses, hollow trees, logs, snags, abandoned burrows, or woodrat nests. Young reportedly are born during May and June (CDFG Website 2006b).

ROSE-MALLOW

Rose-mallow (*Hibiscus lasiocarpus*) occurs along the Sacramento River and adjoining sloughs from Butte County to the Delta (DBW Website 2001). Outside California, the species is widespread, but threatened, in western North America and occurs as far east as Missouri. In California, rose-mallow is restricted to freshwater marshes in riverine backwaters, irrigation canal banks, and Delta islands. It is associated with tules, willows, buttonwillow, and other marsh and riparian species on heavy silt, clay, or peat soils.

SANFORD'S ARROWHEAD

Sanford's arrowhead (*Sagittaria sanfordii*) grows in shallow, standing fresh water and sluggish waterways associated with marshes, swamps, ponds, vernal pools, lakes, reservoirs, sloughs, ditches, canals, and other water bodies (Hickman 1993). This species mostly is extirpated from the Central Valley (Hickman 1993).

SILKY CRYPTANTHA

Silky Cryptantha (*Cryptantha crinita*) is an annual herb that occurs in gravelly streambeds of a wide variety of habitats including cismontane woodland, lower montane coniferous forest, riparian scrub, riparian woodland, and valley and foothill grassland. This species typically is found in sand and gravel deposits associated with seasonal and sometimes perennial streams of the Cascade Range Foothills (Hickman 1993).

SNOWY EGRET

Snowy egrets (*Egretta thula*) are widespread in California along shores of coastal estuaries, fresh and saline emergent wetlands, ponds, slow-moving rivers, irrigation ditches, and wet fields. In northern California, snowy egrets are common from March to November in coastal lowlands and are locally common in the Central Valley year-round. Recently, nesting colonies have been observed near Redwood City, San Rafael, Pittsburg, Los Banos, and several locations in southern California. Specific habitat use information is limited, but the species apparently roosts in dense, emergent vegetation and in trees near water (CDFG Website 2006b). Individuals require either dense emergent wetland habitat or trees within daily commuting range of suitable aquatic or wetland feeding areas.

Many individuals from central California migrate to Mexico during early fall and winter. Thereafter, remaining snowy egrets apparently are non-migratory in much of California, although individuals disperse from nesting colonies after breeding. Individuals vacate the northeastern plateau from November to March while much of the population along the central California coast departs from December to February.

Snowy egret diets consist of small fish, crustaceans, large insects, amphibians, reptiles, worms, snails, and small mammals. Feeding occurs in shallow water or along shores of wetlands or aquatic habitats. This species reportedly is the most active feeder of the California herons, often dashing through shallow water after prey. Like other herons, snowy egrets also stalk slowly or stand and wait for prey. Rarely, individuals hover just above the water and drop on surface prey (CDFG Website 2006b).

In southern California, dense marshes reportedly are required for nesting. However, snowy egrets also nest in low trees. Typically, tree nests are 5 to 10 feet above the ground, but may be up to 30 feet. Nests are constructed of sticks. San Francisco Bay colonies nested at ground level on *Grindelia humilis*, *Salicornia pacifica*, and most often on *Baccharis pilularis* from 1 to 6 feet above ground (CDFG Website 2006b). Breeding occurs in colonies from late March to mid-May in southern and central California, and late April to late August in northern California. Semi-altricial, downy young are tended by both parents, and leave the nest at 20 to 25 days of age.

SWAINSON'S HAWK

Swainson's hawks (*Buteo swainsoni*) are medium-sized hawks with relatively long, pointed wings and a long, square tail. Adults weigh approximately 2 pounds and have a wingspan of approximately 48 inches (CDPR, Endangered Species Project Website 2006).

Swainson's hawks were once found throughout lowland California and were absent only from the Sierra Nevada, north Coast Ranges, Klamath Mountains, and portions of the desert regions of the state. Currently, Swainson's hawks are restricted to portions of the Central Valley and Great Basin regions. Central Valley populations are centered in Sacramento, San Joaquin, and Yolo counties. Swainson's hawks that breed in California may spend winters as far south as Mexico and South America. Central Valley birds appear to winter in Mexico and Columbia. Southward migration through California occurs during September and October. Return migration occurs from March through May (CDFG Website 2006b).

Swainson's hawks require large, open grasslands with abundant prey in association with suitable nest trees. Suitable foraging areas include native grasslands or lightly grazed pastures including alfalfa and other hay crops, and certain grain and row croplands (CDFG Website 2006b). Suitable nest sites may be found in mature riparian forest, lone trees or groves of oaks, cottonwoods, walnuts, other trees in agricultural fields, and mature roadside trees (CDFG Website 2006b). Over 85 percent of Swainson's hawk territories in the Central Valley are in riparian systems adjacent to suitable foraging habitats (CDFG Website 2006b).

Swainson's hawk diets are varied and includes mice, gophers, ground squirrels, rabbits, large arthropods, amphibians, reptiles, birds, and, rarely, fish (CDFG Website 2006b). Individuals soar at low and high altitudes in search of prey, but also may walk along the ground to catch invertebrates and other prey. Competitors for food include northern harriers, red-tailed hawks, black-shouldered kites, burrowing owls, and golden eagles (CDFG Website 2006b).

Swainson's hawks nest on a platform of sticks, bark, and fresh leaves in a tree, bush, or utility pole from approximately 4 feet to 100 feet above the ground (CDFG Website 2006b). Nests primarily are located in open riparian habitat, in scattered trees or small groves in sparsely vegetated flatlands, including trees located in or near agricultural fields (CDFG Website 2006b). Breeding occurs from late March to late August, with peak activity occurring during late May through July. Average clutch size is two to four eggs (CDFG Website 2006b).

TRICOLORED BLACKBIRD

The tricolored blackbird (*Agelaius tricolor*) is a highly colonial species that is mostly endemic to California (CDFG Website 2006b). It is most numerous in the Central Valley and vicinity, but also occurs in the foothills surrounding the valley. In addition, the species occurs sparsely in coastal California, Oregon, and northwestern Baja California.

During late March and early April, tricolored blackbirds vacate wintering areas in the Delta and along coastal central California, and arrive at breeding locations in Sacramento County and throughout the San Joaquin Valley (CDFG Website 2006b). The timing of major movements to wintering areas is unknown.

Tricolored blackbird breeding colonies typically occur near open accessible water, typically in thorny or spiny vegetation such as Himalaya blackberry (*Rubus discolor*) (CDFG Website 2006b). Nesting colony sites typically are located within a couple of miles of foraging habitat. Nesting colonies are reported to typically occur in freshwater marshes dominated by wetland and riparian species including bulrushes (*Scirpus* spp.), cattails (*Typha* spp.), blackberry shrubs, willows, poison oak, cottonwoods, ash, and alder.

Tricolored blackbird breeding colonies range from 50 nests to as many as 100,000 nests reported in cattail marshes of approximately 10 acres or less (CDFG Website 2006b). Breeding typically occurs during the spring with most breeding occurring during late March through April. However, some breeding may continue through June in some colonies where predation of initial nests occurs. Nests typically are bound to upright plant stems from a few centimeters up to approximately 6 feet above water or ground. However, nests in the canopies of willows and ashes may be several meters high.

Tricolored blackbirds forage in pastures, dry seasonal pools, agricultural fields, feedlots, and dairies (CDFG Website 2006b). Occasionally, individuals have been observed foraging near nesting habitat in riparian scrub, marshes, and grasslands. Typically, tricolored blackbirds forage away from nest sites, up to approximately three miles, but foraging has been reported up to approximately eight miles from the nesting colony. During the nesting season grasshoppers and other locally abundant insects including beetles, weevils, caddisfly larvae, moth larvae, butterfly larvae, and dragonfly larvae comprise the majority of tricolored blackbirds' diets. Winter feeding, however, consists mostly of plant material, primarily seeds of rice and other grains.

VALLEY ELDERBERRY LONGHORN BEETLE

The valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) is a medium-sized beetle (0.8 inch long) in the long-horned wood-boring family Cerambyciadae. Sexes are dissimilar in appearance. Whereas the females' forewings are dark metallic green with red margins, the males' are primarily red with dark green spots.

The valley elderberry longhorn beetle is endemic to California and its historic range consists of all of the Central Valley. However, the current range is much smaller, extending from the northern end of the Central Valley at Redding to the Bakersfield area (Barr 1991). In the foothills of the Sierra Nevada, adult beetles have been found in elevations up to 2,200 feet and exit holes have been found at elevations up to 2, 940 feet. Along the Coast Ranges, adult beetles have been found up to 500 feet elevation, and exit holes have been detected up to 730 feet.

Little is known about the life history of valley elderberry longhorn beetle and its ecological requirements except that its entire life is associated with blue elderberry shrubs (*Sambucus mexicana*). Collection records indicate that adult beetles may be found from mid-March until early June, and emergence is synchronized with the flowering period of the elderberry host. Eggs are deposited in cracks and crevices of the bark of a living elderberry plant and hatch shortly after they are laid (Steinhart 1990). The larvae tunnel into the soft core of elderberry stems, excavating passages in the wood as they feed. Larvae may remain in this stage for as long as two years before emerging as adults. While larvae feed on the pith and roots of the elderberry bushes and trees (USFWS 1984), adults are thought to feed on flowers (Barr 1991).

Suitable habitat is defined as any elderberry shrub that has stems one inch or greater in diameter at the ground level (USFWS 1999; USFWS Website 2005). Elderberry shrubs are considered a riparian species and commonly are found along the banks of Central Valley streams and rivers and in adjacent upland habitats.

The presence of exit holes in blue elderberry stems is an indication of previous valley elderberry longhorn beetle use. The distinctive oval exit holes are approximately 0.25 inch in diameter and can be found from a few inches above the ground to about 10 feet up on stems ranging from one to eight inches in diameter (Barr 1991).

WESTERN YELLOW-BILLED CUCKOO

The yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is a medium-sized song bird approximately 12 inches in length that weighs approximately 2 ounces. The species has a slender, long-tailed profile, with a fairly stout and slightly downwardly curved bill, which is blue-black with yellow on the base of the lower mandible. Plumage is grayish-brown above and white below, with red primary flight feathers. The tail feathers are boldly patterned with black and white below. The legs are short and bluish-gray. Adults have a narrow, yellow eye ring. Juveniles resemble adults, except the tail patterning is less distinct, and the lower bill may have little or no yellow.

In California, prior to the 1930s, western yellow-billed cuckoos were widely distributed in suitable habitats, and were locally common (Grinnell and Miller 1944). In recent years, the species' distribution in the west has contracted. The northern limit of breeding in the coastal States is now in the Sacramento Valley (USFWS Website 2006).

Based on a statewide survey conducted during 1986 and 1987, only three areas in the state regularly support more than about five breeding pairs: (1) the Sacramento River roughly between Colusa and Red Bluff; (2) the South Fork of the Kern River upstream of Lake Isabella; and (3) the lower Colorado River (Laymon and Halterman 1987). Nesting requires an area of dense understory near water or with high humidity, which qualifies the species as an obligate riparian nester. Typically, cuckoo nests are in willows, small cottonwoods, or mesquite, with a well protected overhead area (Hughes 1999).

In the western United States, yellow-billed cuckoos breed in broad, well-developed, low-elevation riparian woodlands comprised primarily of mature cottonwoods and willows. Studies along the Lower Colorado River Valley and throughout their range have shown that smaller willow-cottonwood stands (less than 100 acres) have low rates of occupancy, whereas large sites (>200 acres) have the highest occupancy rates. Typical nest sites in California (N = 18 nests) had moderately high canopy closure (79.6 percent) and low total ground cover (18.7 percent). The average distance from nests to water was 114 feet (Laymon and Halterman 1987). Along the Sacramento River in Glenn County, yellow-billed cuckoos have been documented nesting in walnut orchards adjacent to riparian habitats (Gaines and Laymon 1984).

Some researchers place the average area required for a nesting pair at approximately 42 acres (66 FR 38611 (July 25, 2001)). However, models developed for restoration efforts suggest that that riparian patches > 200 acres in extent and wider than 1,950 feet were optimal, sites 101 to 200 acres in extent and wider than 650 feet were suitable, sites 50 to 100 acres in extent and 325 to 650 feet in width were marginal, and sites less than 38 acres in extent and less than 325 feet in width were unsuitable as yellow-billed cuckoo habitat (Laymon and Halterman 1987).

Spring migration into California begins during late May and lasts until late June (Laymon and Halterman 1987). The breeding season for yellow-billed cuckoos generally begins with pair formation during mid-June and lasts until mid-August. From June to August females lay one to five eggs, and both parents incubate them for 9 to 11 days. Both parents feed the nestlings until they fledge at approximately seven to nine days of age. The rapid rate of development allows for the species' short stay in California. In California, western yellow-billed cuckoos return annually to nearly all of the few recently occupied breeding locations remaining in suitable condition, which suggests strong nest-site fidelity.

Fall migration begins during late August and lasts until mid-September. The species over-winters from Columbia and Venezuela, south to northern Argentina (Ehrlich *et al.* 1988). Migration patterns, corridors, and critical stopovers are largely unknown. Like most songbirds, the yellow-billed cuckoo migrates at night.

Western yellow-billed cuckoos are restricted to the mid-summer period for breeding presumably due to a seasonal peak in large insect abundance (USFWS Website 2006). They typically feed on insects such as grasshoppers, caterpillars, and cicadas, but also opportunistically feed on frogs and lizards, and occasionally feed on fruit (CDFG Website 2006b). Each pair requires a minimum of 25 acres in which to forage, which primarily occurs in Fremont cottonwood stands and upland areas.

WHITE-FACED IBIS

The white-faced ibis (*Plegadis chihi*) is a rare visitor to the Central Valley, and is more widespread in migration. The species prefers to feed in fresh emergent wetland, shallow lacustrine waters, muddy ground of wet meadows, and irrigated or flooded pastures and croplands.

White-faced ibises roost amid dense, freshwater emergent vegetation such as bulrushes, cattails, reeds or low shrubs over water (CDFG Website 2006b). Extensive marshes are required for nesting and the nest itself is made of dead tules or cattails (CDFG Website 2006b).

Feeding generally occurs as individuals probe deep into the mud surrounding marshes with their long bills, but also occurs in shallow water or on the water's surface (CDFG Website 2006b). White-faced ibis diets consist of earthworms, insects, crustaceans, amphibians, small fishes, and miscellaneous invertebrates.

WHITE-TAILED KITE

White-tailed kites (*Elanus leucurus*) are a common to uncommon, year-long resident in coastal and valley lowlands who are rarely found away from agricultural areas (CDFG Website 2006b).

White-tailed kites breed in lowland grasslands, agricultural fields, wetlands, oak-woodland and savannah habitats, and riparian areas associated with open areas (CPIF 2000). Precipitation is highly variable among kite habitats, though kites are uncommon in areas with extensive winter freezes. Kites do not seem to associate with particular plant species, but presence is more tightly correlated to prey abundance and vegetation structure. Habitats supporting larger prey populations, such as undisturbed, open grasslands, meadows, farmlands and emergent wetlands are considered higher quality kite habitats (CDFG Website 2006b). Summer habitat preferences include riparian zones, dry pastures, alfalfa, orchards, and rice stubble fields.

White-tailed kites forage from a central perch over areas as large as 1.9 square miles (CDFG Website 2006b). They seldom hunt more than 0.5 mile from nest sites during the breeding season, and one study found mean breeding home range to be 0.2 mile. Prey mostly consists of voles and other small, diurnal mammals. Occasionally birds, insects, reptiles, and amphibians also are consumed (CDFG Website 2006b).

YELLOW WARBLER

The yellow warbler (*Dendroica petechia*) is a summertime visitor to California, after wintering in Mexico and South America. Usually arriving during April, individuals mostly are gone by October (CDFG Website 2006b). Their breeding distribution includes from the coast range in

Del Norte County, east to Modoc plateau, south along the coast range to Santa Barbara and Ventura counties, and along western slope of Sierra Nevada south to Kern County (CDFG Website 2006b). Yellow warblers breed in riparian woodlands from coastal and desert lowlands up to 8,000 feet in the Sierra Nevada. The number of breeding pairs has declined in recent decades in many lowland areas (southern coast, Colorado River, San Joaquin and Sacramento valleys) and the species is now considered rare to uncommon in many lowland areas where they formerly were common.

The presence of yellow warblers is considered an indicator of riparian habitat quality. During the summer, yellow warblers usually are found in riparian deciduous habitats consisting of cottonwoods, willows, alders, and other small trees and shrubs typical of low, open-canopy riparian woodland. During migration individuals rest in woodland, forest, and shrub habitats (CDFG Website 2006b).

Yellow warblers mostly consume insects and spiders. Nests are open cups placed 2 to 16 feet above the ground in a deciduous sapling or shrub. Territory often includes tall trees for singing and foraging and a heavy brush understory for nesting (CDFG Website 2006b).

YELLOW-BREASTED CHAT

Yellow-breasted chats (*Icteria virens*) were once fairly common summer residents in riparian woodland habitats throughout California (CDFG Website 2006b), but currently are much reduced in numbers. In the Sacramento Valley population estimates have decreased, but remain relatively high in the upper Sacramento Valley (CDFG Website 2006b). In Napa and Sonoma counties, the species is still relatively common but population estimates have decreased have declined from former levels (CDFG Website 2006b). Population estimates of migrant chats along the coast have dropped in recent years (CDFG Website 2006b).

Yellow-breasted chats typically forage for insects and spiders, but also consume berries and other fruits. Foraging behavior typically consists of gleaning foliage of shrubs and low trees (CDFG Website 2006b). Foraging frequently occurs in dense, brushy thickets and tangles near water, and in the thick understory of riparian woodlands (CDFG Website 2006b).

YELLOW-HEADED BLACKBIRD

Yellow-headed blackbirds (*Xanthocephalus xanthocephalus*) breed commonly, but locally, east of the Cascade Range and Sierra Nevada, in the Imperial and Colorado River valleys, and relatively commonly in the Central Valley. Much of California's breeding population migrates south to winter, yet they can be an uncommon winter resident in the Central Valley.

Yellow-headed blackbirds often nest in fresh emergent wetlands with dense vegetation and deep water that border lakes or ponds (CDFG Website 2006b). Foraging occurs in emergent wetlands and moist, open areas, especially in cropland and on muddy shores of lacustrine habitat. Foraging grounds may be as far as 1 mile from the nesting colony and probably considerably farther from winter roosts (CDFG Website 2006b). Territories have been reported that averaged 1,250 square feet, 400 to 500 square feet, 4,900 square feet and 30,000 square feet, and 0.03 acre (CDFG Website 2006b).

Adults feed primarily on seeds and cultivated grains, but eat insects during the breeding season. Young yellow-headed blackbirds are fed mostly insects, as well as some spiders and snails.

YUMA MYOTIS BAT

Yuma myotis bats (*Myotis yumanensis*) are more closely associated with water than any other North American species of bat (CDFG Website 2006b). Open water is a key habitat element for this species and they are commonly found in association with low elevation reservoirs. Optimum habitats are further characterized by cliffs and rocky walls near desert scrub, pinyon-juniper woodlands, and other open woodlands and forests. In California, they are found from sea level to over 11,000 feet, but are uncommon above 8,000 feet.

Yuma myotis bats are known to roost in buildings, heavily forested settings, caves, mines, trees (such as hollow redwood trees), rock crevices, under bridges, and in abandoned cliff swallow mud nests (CDFG Website 2006b). Yuma myotis bats form large maternity colonies between May and June and young are born in June and July.

Yuma myotis bats typically forage just above relatively calm water surfaces, such as ponds, reservoirs, or pools along streams and rivers (CDFG Website 2006b). This species preys on emergent aquatic insects such as caddisflies and midges. Moths, leafhoppers, June beetles, ground beetles, muscid flies, and craneflies also may be taken. This species has a relatively poor urine concentrating ability and, thus, is frequently observed drinking from the surface of relatively calm water bodies.

11.1.2 DESCRIPTION OF THE PROJECT STUDY AREA

11.1.2.1 YUBA REGION

The Yuba Subbasin is located on the eastern edge of the Sacramento Valley. It is bounded by the Feather River to the west, the Bear River to the south, Honcut Creek to the north, and the Sierra Foothills to the east. The primary land use is agriculture with rice, pasture, and fruit and nut trees accounting for most of the crops. Rice fields are flooded during fall for rice stubble decomposition and the creation of wintertime waterfowl habitat. Agricultural drains and canals support hydrophytic vegetation in some areas and provide some wetland-type habitat for adaptable wildlife species. In addition to agricultural land, the valley floor supports non-native grassland. The Upper Yuba watershed is located within the Sierra Nevada foothills. Habitats in the Upper Yuba area include blue oak woodland and foothill pine-oak woodland, as well as mixed conifer forest, black oak woodland, black oak forest, interior live oak woodland, and valley oak woodland.

The Yuba River is a tributary of the Feather River, which in turn is a tributary of the Sacramento River. The Yuba River watershed is one of the most intensively used watersheds in the Sierra Nevada, while the river itself is one of the most managed waterways in the Sierra Nevada (SYRCL 2002). Biotic communities in the Yuba Region historically have been influenced by, and continue to be influenced by, hydraulic mining, roads, fragmented land ownership, water diversions, on-stream water impoundments, hydropower generation, and flood control structures. Riparian communities found in the Yuba Region have resulted from the managed flows that are a consequence of various regulations. For example, ramping rates are prescribed in the FERC license for the Narrows II Powerhouse. Reservoir storage is prescribed by the Corps' flood control requirements. Instream flows are prescribed in the water right permits administered by the RWQCB.

NEW BULLARDS BAR RESERVOIR

Vegetative communities adjacent to New Bullards Bar Reservoir predominantly are oak woodland types with some chaparral, and mixed conifer and montane hardwood communities occurring at higher elevations. The oak woodland communities include interior live oak (*Quercus wizlizenii*), blue oak (*Quercus douglasii*), and foothill pine (*Pinus sabiniana)*, with several species of understory shrubs and forbs including poison oak, manzanita (*Arctostaphylos* spp.), California wild rose (*Rosa californica*), and lupine (*Lupinus* spp*.)*. However, the reservoir shoreline mostly is devoid of vegetation as a result of clearings and frequent fluctuations in water surface elevations. Wildlife species that typically use oak woodlands and chaparral habitats in the Central Valley are considered to utilize the habitat adjacent to New Bullards Bar Reservoir.

New Bullards Bar Reservoir supports a pair of nesting southern bald eagles, which are listed as endangered under CESA and listed as threatened under the federal ESA (EDAW 2003). Bald eagle production may be adversely affected by extreme drawdown of reservoirs during the period when eagle chicks are in the nest (DWR 1988). One occurrence (1997) of California red-legged frog in the Yuba River area has been recorded in CDFG's CNDDB. This record is from Oregon Creek about 2 miles from upper New Bullards Bar Reservoir.[3] In 2006, USFWS designated critical habitat for the California red-legged frog, which includes land within the Oregon Creek watershed, approximately 0.5 mile upstream of New Bullards Bar Reservoir (71 FR 19243 (April 13, 2006)).

LOWER YUBA RIVER

The lower Yuba River extends approximately 24 miles from Englebright Dam to its confluence with the Feather River (YCWA 2003a). Where hydrologic conditions are supportive, riparian and wetland vegetative communities are found adjacent to the lower Yuba River and on the river-side of the retaining levees. These communities are dynamic and have changed over time as the river has meandered. The plant communities along the river are a combination of remnant Central Valley riparian forests and woodlands, foothill oak/pine woodlands, agricultural grasslands, and orchards (CDFG 1989).

Since completion of New Bullards Bar reservoir, the riparian community has expanded under stream flow conditions that have generally been higher than those initially required (SWRCB

[3] Red-legged frogs reportedly have been observed in Oregon Creek, approximately two miles from New Bullards Bar Reservoir and in remnant hydraulic mining ponds associated with Willow Creek, which is approximately one mile upstream of the reservoir in the Tahoe National Forest (pers. comm., M. Tierny, Tahoe National Forest 2007). Because adult California red-legged frogs are known to migrate in search of suitable habitat, it is assumed that California red-legged frogs could potentially migrate to New Bullards Bar Reservoir. However, it is unlikely that New Bullards Bar Reservoir provides suitable habitat for red-legged frogs (pers. comm., M. Tierny, Tahoe National Forest 2007). Specifically, red-legged frogs typically utilize quiet pools of streams, ponds, marshes, and riparian habitats (USFWS 2002) characterized by a lack of introduced predatory fish species (66 FR 14626 (March 13, 2001)). Moran Cove, the nearest potentially suitable reservoir area downstream of the known California red-legged frog population associated with Willow Creek has been surveyed numerous times since 1997 and no red-legged frogs have been reported utilizing the cove (pers. comm., M. Tierny, Tahoe National Forest 2007). Based on the lack of suitable habitat in the reservoir and the lack of reported red-legged frog utilization of the reservoir, it is unlikely that red-legged frog populations currently utilize or could persist in the reservoir. Therefore, changes in New Bullards Bar Reservoir water surface elevation are not expected to alter California red-legged frog utilization of the reservoir and are considered insignificant effects to red-legged frog habitat.

2003). However, the riparian habitat is not pristine. In its "*Final Biological and Conference Opinion for the Yuba River Development Project License Amendment (FERC No. 2246)*" NMFS (2005) reports on Page 36:

> *The deposition of hydraulic mining debris, subsequent dredge mining, and loss/confinement of the active river corridor and floodplain of the lower Yuba River which started in the mid-1800's and continues to a lesser extent today, has eliminated much of the riparian vegetation along the lower Yuba River. In addition, the large quantities of cobble and gravel that remained generally provided poor conditions for re-establishment and growth of riparian vegetation. Construction of Englebright Dam also inhibited regeneration of riparian vegetation by preventing the transport of any new fine sediment, woody debris, and nutrients from upstream sources to the lower river. Subsequently, mature riparian vegetation is sparse and intermittent along the lower Yuba River, leaving much of the bank areas unshaded and lacking in large woody debris. This loss of riparian cover has greatly diminished the value of the habitat in this area.*

Reach-by-reach descriptions also provide insights into the lower Yuba River's riparian communities (**Figure 11-1**).

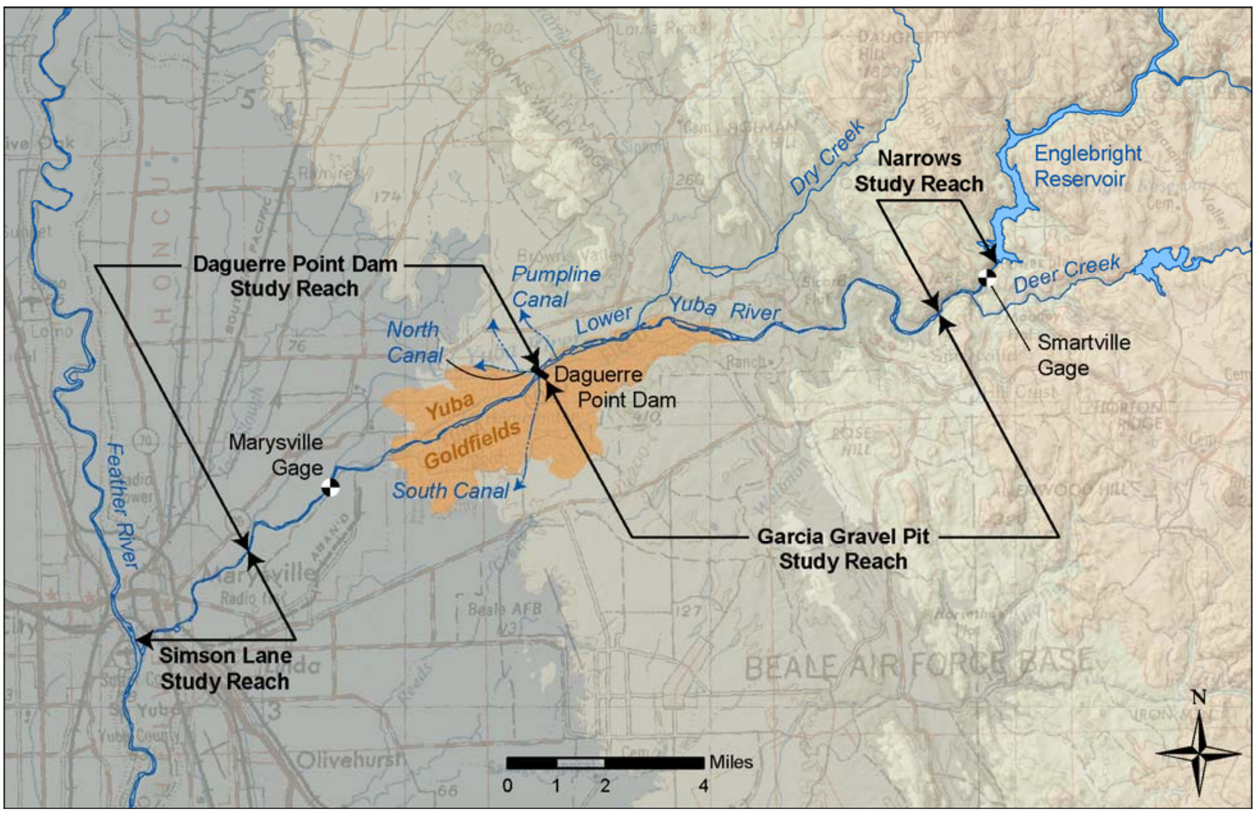

Figure 11-1. Lower Yuba River Riparian Communities

<u>Narrows Reach</u>

The Narrows Reach extends from Englebright Dam about two miles downstream to the mouth of the Narrows Canyon (NMFS 2005). In this reach, the channel is steep and consists of a series of rapids and deep pools confined by a bedrock canyon. YCWA (2003b) described the area in the "*Narrows II Powerplant Flow Bypass System Initial Study*" as follows:

> *Small isolated clumps of willow (Salix lasiolepis), mulefat (Baccharis salicifolia), and other riparian species are widely scattered along the otherwise barren, rocky banks of the Yuba River downstream of the Narrows 2 Powerplant and along the shoreline of Englebright Reservoir. Wildlife species expected along the Yuba River include black phoebe (Sayornis nigricans), belted kingfisher (Ceryle alcyon), and waterfowl, such as common merganser (Mergus merganser). Blue oak-foothill pine habitat is common on the hillsides that surround the project site. Wildlife species common to the Sierra Nevada foothills include mule deer (Odocioileus hemionus), western fence lizard (Sceloporus occidentalis), and mourning dove (Zenaida macroura).*

Deer Creek enters the Yuba River in this reach at RM 23. Freshwater emergent wetlands are often found at stream confluences, which also tend to have high species diversity.

Garcia Gravel Pit Reach

Downstream of the Narrows Reach, the channel enters the alluvial valley plain where massive quantities of hydraulic mining debris remain from past gold mining operations (NMFS 2005). Whereas CDFG (1989) observed that the dominant linear feature of the Garcia Gravel Pit Reach was blue oak/gray pine woodland (35 percent), and riparian vegetation (44 percent), NMFS (2005) observed more shaded riverine habitat in the Garcia Gravel Pit Reach than in the Daguerre Point Reach, suggesting that conditions for this reach may have improved between 1989 and 2005. Dry Creek enters the Yuba River in this reach at RM 14.

Daguerre Point Reach

Like the Garcia Gravel Pit Reach, the Daguerre Point Reach also is dominated by mining debris. (CDFG 1989) observed that riparian vegetation was the dominant streamside feature (72 percent) of the Daguerre Point Reach. A recent reconnaissance-level survey conducted on October 16, 2006 indicated that the riparian habitat within the Daguerre Point Reach consists of shrubby willow species including, arroyo willow (*Salix lasiolepsis*), sandbar willow (*Salix exigua*), and shining willow (*Salix lucida*) interspersed with Fremont's cottonwoods. Additionally, the flows at which the survey was conducted (approximately 550 cfs at Marysville) revealed that relatively large stage changes would be required to inundate substantial amounts of riparian habitat. Inundated wetland habitat was not observed during the reconnaissance survey.

Simpson Lane Reach

The Simpson Lane Reach is subject to backwater influences of the Feather River (NMFS 2005) . CDFG (1989) observed that that riparian vegetation was the dominant streamside feature (78 percent) of the Simpson Lane Reach, while the EWA EIS/EIR observed grassland, agricultural fields, as wells as barren land (Reclamation *et al.* 2003).

YUBA COUNTY WATER AGENCY MEMBER UNIT SERVICE AREAS

On the land-side of the retaining levees, seasonally flooded agriculture and grasslands are the primary communities, with lesser amounts of freshwater wetlands, including vernal pools. However, these communities would not be affected by implementation of the Proposed Project/Action or an alternative and, therefore, are not included in the impact analyses in this chapter (see Section 11.1.1.2). Communities that are dependant upon YCWA's canals and conveyance structures also were not included in the impact analyses because YCWA operations of these canals and structures will not change.

Daguerre Point Dam is the primary diversion point for water entering the Hallwood-Cordua Canal and the South Canal, which supply the water districts located north and south of the lower Yuba River, respectively. The canal systems' operations for all service areas are similar and follow standard practices. The following discussion describes these standard operations. Water levels in the Hallwood-Cordua and South canals are manually controlled year-round using board weirs. Minimum water levels are maintained to ensure there is enough pressure for any user to divert water when needed (pers. comm., McDaniel 2006). While water elevations in these primary conveyances remain constant, the flow rates through these conveyances may change with changes in agricultural demands. Groundwater pumping has no effect on surface water levels in the primary conveyances because not all farmers have groundwater wells and those who do use groundwater may supplement it with surface water. For example, during the 1991 transfer, groundwater supplied 40 percent of the irrigation water, and during more recent transfers, groundwater supplied up to 20 percent of irrigation water (pers. comm., McDaniel 2006). Hence, even during seasons when farmers are implementing groundwater conjunctive use measures, water levels are maintained in the primary conveyances for those districts or farmers that are not participating in the conjunctive use programs.

From the primary conveyances, the irrigation districts use smaller ditches to supply water to their customers according to the following seasonal considerations:

- **Irrigation Season, April 1 through October 15:** The secondary conveyance ditches are manually controlled using board weirs to maintain constant water levels during the irrigation season and to ensure that water is available when needed. Similar to the primary conveyances, water levels in secondary canals are maintained regardless of the amount of groundwater being pumped.
- **Waterfowl/Straw Management Season, October 15 through January 31:** The secondary conveyance ditches are maintained at constant water levels during this time; however, water levels are at lower elevations than during the irrigation season. During this time, water is maintained for use in rice fields to support migratory waterfowl.
- **Maintenance Season, January 31 through April 1:** Maintenance can take place any time on an as-needed basis, but if it can be deferred, it is done during this designated time period. Although ditches may have water in them at any time, the water levels in the secondary conveyance ditches are not actively managed during this time and these ditches may go dry. When maintenance is required and there is water in a ditch, the area needing maintenance is isolated and dewatered.

Excess applied irrigation water from each field re-enters conveyance ditches and can go to the next downstream farmer. Efforts are made to keep the proportion of re-applied water to less than 7 percent. Eventually, all excess irrigation water enters the Bear River, a tributary of the Feather River located downstream of the Yuba River confluence, or the Feather River. Hence, no water used for irrigation in the YCWA service areas or on lands overlying the North Yuba and South Yuba subbasins ends up in the Yuba River.

Member Units receive their irrigation water from the Yuba River through the system of delivery canals and natural creeks, and return water to the Bear River through the system of drainage canals. Functionally, the delivery canals and creeks are separate from the drainage canals because water quality and water surface elevations in the canals may be dramatically different, but the habitat value for many species renders the delivery canals and drainage canals similar.

Specifically, the canals provide habitat for species such as giant garter snakes and a variety of aquatic plants.

Vegetation adjacent to the canals in this region consists of blackberries (*Rubus, sp*.) and grasses. There is occasional spraying, though it is not regular. Aquatic weeds, including American pond weed (*Potamogeton nodosus Poir*) and parrot feather (*Myriophyllum aquaticum*), have infested the ditches and, when needed, chemical treatments may be utilized to control these weeds. Some vegetation, like cattail (*typha, sp*.), is manually removed if it is disrupting or clogging the system.

As a result of the preceding operational discussion, the YCWA service area and lands overlying the North and South Yuba subbasins are not being analytically addressed because the Proposed Project/Action and alternatives, relative to the bases of comparison, are not expected to contribute to any changes in: (1) the water levels of primary conveyances, which are kept at constant levels year-round; (2) the water levels of smaller conveyance ditches, which are kept at constant levels during the irrigation season, regardless of the amount of groundwater being pumped; or (3) the quantity or timing of the application of irrigation water to agricultural fields. Hence, terrestrial wildlife species, including giant garter snakes, potentially associated with the habitat communities found in these areas will not be affected by the Proposed Project/Action or alternatives.

11.1.2.2 CVP/SWP UPSTREAM OF THE DELTA REGION

Major water features of the CVP/SWP upstream of the Delta Region are Shasta Reservoir and the Sacramento River, which is influenced by the CVP (operated by Reclamation), and Oroville Reservoir and the Feather River, which is influenced by the SWP (operated by DWR). The American and Trinity rivers and their associated storage and conveyance facilities are not considered part of the terrestrial biological resources study area associated with this project because they will not be affected by the Proposed Project/Action or any alternative. A detailed description of the CVP/SWP Upstream of the Delta Region is provided in Chapter 2.

FEATHER RIVER BASIN

The lower Feather River extends from the Fish Barrier Dam (RM 67.25), just downstream of Oroville Reservoir, to its confluence with the Sacramento River (RM 0). Flows in the lower Feather River are influenced by DWR's operation of Oroville Dam and Reservoir. The Yuba River and Bear River are both tributaries to the Feather River.

Oroville Reservoir

Vegetative communities adjacent to Oroville Reservoir are predominantly oak woodland types with some chaparral. The oak woodland communities include live oak, blue oak, and foothill pine, with several species of understory shrubs and forbs including poison oak, manzanita, California wild rose, and lupine. The reservoir rim is mostly devoid of vegetation as a result of clearings and frequent water surface elevation fluctuations. An occasional isolated button bush (*Cephalanthus occidentalis*) or willow can be observed within the drawdown zone. Wildlife species that typically use oak woodlands and chaparral habitats in the Central Valley utilize the habitat surrounding the reservoir. In addition, large numbers of waterfowl and gulls overwinter at Oroville Reservoir and in the vicinity of the Thermalito Afterbay.

Lower Feather River

The lower Feather River is the largest tributary to the Sacramento River and supports a diversity of riparian and wetland vegetative and wildlife communities. Willow scrub riparian habitat occupies frequently flooded areas closest to the river. Cottonwoods are more prominent in less frequently flooded areas, but still require and tolerate regular inundations. Valley oaks occupy the least flooded portion of the river. Backwater areas support freshwater emergent wetlands, which contribute to the overall habitat diversity of the river. Wildlife species typically found in riparian habitats of the Central Valley utilize the riparian habitats associated with the Feather River. Additionally, the lower Feather River provides riverine habitat which is utilized by several otherwise terrestrial species. Mammals, such as river otter (*Lontra canadensis)* and muskrat (*Ondatra Zibethicus*), directly utilize riverine habitat for foraging and cover. Herons, egrets, and ospreys typically forage on fish and amphibians living in the river. Many amphibians and some reptiles (e.g., western pond turtles) inhabit riverine habitats for at least part of their life cycles.

SACRAMENTO RIVER BASIN

Flows in the Sacramento River are influenced by Reclamation's operation of Shasta Dam and Reservoir for the CVP. The Feather River is a tributary to the Sacramento River.

Sacramento River

Much of the Sacramento River is confined by levees that reduce the natural diversity of riparian vegetation. Riparian vegetation along the lower Sacramento River is largely confined to narrow bands between the river and the river-side of the levees. The riparian communities consist of valley oaks, cottonwoods, wild grape vines, box elders, elderberry shrubs, and various willow species. The largest and most significant tract of riparian forest remaining on the Sacramento River is a stretch between Chico Landing and Red Bluff. Freshwater emergent wetlands occur in some slow-moving backwaters and primarily are dominated by bulrushes, cattails, rushes, and sedges (SAFCA and Reclamation 1994). Special-status species inhabiting the riparian habitats along the lower Sacramento River are those typically found in riparian habitats in the Central Valley, and include species such as western yellow-billed cuckoo and valley elderberry longhorn beetle. A variety of wildlife species directly use the riverine habitat provided by the Sacramento River. Mammals such as river otters and muskrats utilize riverine habitats for foraging and cover. Herons, egrets, and ospreys typically forage on fish and amphibians living in the river. Many amphibians and some reptiles (e.g., western pond turtles) inhabit riverine habitats for at least part of their life cycles.

Wildlife refuges along the Sacramento River provide habitat for resident and migratory waterfowl, threatened and endangered species, and wetland dependent aquatic biota. These refuges include the Sacramento, Colusa, Sutter, and Delevan NWRs and Gray Lodge Wildlife Management Area (WMA). Water supplies for certain wildlife refuges within the Central Valley are administered through CVPIA programs that acquire and convey water.

Water for NWRs is acquired through water supply contracts with "willing sellers".[4] Any water acquired under the Proposed Project/Action or an alternative for NWR-related purposes would be used to help meet Reclamation's obligations under the CVPIA to provide Incremental Level 4 refuge water supply. Water supplies to NWRs along the Sacramento River corridor would not be adversely affected, and would benefit from long-term water transfers to the CVP/SWP system implemented under the Proposed Project/Action (see Chapter 5 for a detailed description of water transfer programs and operations).

11.1.2.3 DELTA REGION

Historically, the Delta supported extensive areas of saline and freshwater emergent marshes. Today, the Delta contains about 641,000 acres of agricultural land (72 percent of the total land area) that dominate its lowland areas. Hundreds of miles of waterways divide the Delta into islands, some of which are below sea level. The Delta has more than 1,000 miles of levees that protect these islands. Much of the freshwater and saline emergent marsh habitat formerly in the Delta has been lost as a result of urban and agricultural development, flood control, and water supply projects; however, some emergent marsh habitat, such as at Suisun Marsh, remain in the Delta. The remaining areas of emergent marsh provide important habitat for many resident and migratory species.

Saline emergent wetland habitat only is present within the study area in the southern portion of the Delta. Although large changes in freshwater inflow to the Delta associated with implementation of the Proposed Project/Action or an alternative would impact the saline emergent wetland communities in the Delta, impacts to saline emergent wetland habitat associated with implementation of the Proposed Project/Action or an alternative are not expected to occur. Specifically, freshwater inflow to the Delta would be minimal and would be within the range of freshwater inflows that has occurred in recent years. Therefore, potential effects to saline emergent wetlands, and associated terrestrial resources, are not evaluated in this chapter.

11.1.2.4 EXPORT SERVICE AREA

The San Luis Reservoir, and the associated O'Neil Forebay, is a water storage reservoir complex located in the eastern part of the Diablo Range in west central California (Figure 2-1). Water is pumped to the reservoir from the California Aqueduct and Delta-Mendota Canal and is released as needed, primarily for irrigation purposes. Depending on water levels, the reservoir is approximately nine miles long from north to south at its longest point, and five miles wide. At the eastern end of the reservoir is the San Luis Reservoir, which allows for a total capacity of 2.041 MAF, making San Luis Reservoir the largest off-stream reservoir in the United States. Because the primary use of San Luis Reservoir is for irrigation, the reservoir typically is below

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[4] Environmental documentation has already been prepared that addresses the overall impacts of acquiring full Level 4 supplies at the refuges, the conveyance of water to the refuges, and use of water on the refuges. The overall impacts of implementing the CVPIA, including providing Level 4 water supplies to the refuges, were addressed in a Final Programmatic EIS (Reclamation and USFWS 1999) and environmental assessments/initial studies (EA/IS). These documents addressed both the conveyance of water to the Sacramento Valley and San Joaquin Valley Wildlife Refuges (Reclamation 1997a; Reclamation 1997b; Reclamation 1997d; Reclamation 1997c; Reclamation and CDFG 2003) and the use of water on these refuges (Reclamation 1997c; Reclamation *et al.* 2001a; Reclamation *et al.* 2001b; Reclamation and USFWS 2001). Therefore, the analysis in this EIR/EIS with respect to refuge water supplies is focused solely on the potential impacts of Reclamation acquiring water to help meet Incremental Level 4 refuge needs.

capacity, particularly in late summer and early fall, and fluctuates substantially throughout the year.

Filling of San Luis Reservoir inundated historic grassland, mesic valley slope, and creek habitats (Reclamation and CDPR 2005). Areas at the edges of O'Neill Forebay reportedly appear to be slowly becoming vegetated with riparian species (Reclamation and CDPR 2005). Sandbar willow and mulefat, two early successional species, form large clumps at the edges of certain areas of the shore of O'Neill Forebay. Other species, such as red willow, black willow, Fremont's cottonwood, and western sycamore are present in low numbers. Riparian vegetation along the shoreline of San Luis Reservoir likely would remain in an early successional stage under normal operating conditions because the fluctuation of the water surface elevation (reportedly 100 feet or more) either inundates the vegetation for extended periods or desiccates the vegetation for extended periods during the dry season.

11.1.3 REGULATORY SETTING

11.1.3.1 FEDERAL

FEDERAL ENDANGERED SPECIES ACT

The ESA requires that both USFWS and NMFS maintain lists of threatened species and endangered species. An "endangered species" is defined as "*any species which is in danger of extinction throughout all or a significant portion of its range*." A "threatened species" is defined as "*any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range*" (16 USC 1532). Section 9 of the ESA makes it illegal to "take" (i.e., harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct) any endangered species of fish or wildlife and most threatened species of fish or wildlife (16 USC 1538).

Section 7 of the ESA requires all federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat. To ensure against jeopardy, each federal agency must consult with USFWS or NMFS, or both, if the federal agency determines that its action might impact a listed species. NMFS jurisdiction under the ESA is limited to the protection of marine mammals and fish and anadromous fish; all other species are within USFWS jurisdiction.

RECLAMATION'S LEGAL AND STATUTORY AUTHORITIES

Each federal agency has an obligation to ensure that any discretionary action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or destroy or adversely modify its critical habitat unless that activity is exempt pursuant to ESA (16 USC 1536(a)(2); 50 CFR 402.03). Under Section 7(a)(2), a discretionary agency action will jeopardize the continued existence of a species if it "*reasonably would be expected, directly or indirectly, to reduce appreciably the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of the species*" (50 CFR 402.02). If a discretionary agency action will jeopardize a species, the agency must prevent the action or modify it through reasonable and prudent alternatives (RPAs), which must be within the scope of the agency's legal authority (50 CFR 402.02). The ESA does not provide Reclamation with any additional authority or jurisdiction. For this project, Reclamation would comply with its obligations under the ESA by avoiding discretionary actions that are likely to jeopardize the continued existence of listed species, avoiding take of listed species unless permitted by USFWS, and using its authorities to conserve listed species. Reclamation must comply with requirements (that are within its legal authority) of any resultant biological opinion to ensure that its action does not jeopardize any listed species, adversely affect designated critical habitat, or result in unauthorized take.

Reclamation also would continue to implement actions to benefit the species under its existing authorities and consistent with its Section 7(a)(1) obligation to conserve and protect listed species. Section 7(a)(1) alone does not give Reclamation additional authority to undertake any particular action, regardless of its potential benefit for endangered species. Whether undertaken as Section 7(a)(1) conservation activities or as RPAs subsequent to Section 7(a)(2) compliance, any Reclamation action for endangered species must be within the agency's existing authorities. Where there is no Section 7(a)(2) question (i.e., no indication that a proposed action is likely to jeopardize species), Reclamation's failure to take an action that is conceivably within its authorities cannot be determined to be a cause of "jeopardy."

FISH AND WILDLIFE COORDINATION ACT

The FWCA (PL 85-624; 16 USC 661-667d) requires that all federal agencies consult with USFWS, NMFS, and the state's wildlife agencies for activities that affect, control, or modify waters of any stream or other bodies of water (Cylinder *et al.* 1995). Under the authority of the FWCA, resource trustees review water development projects and wildlife is given equal consideration and coordination with other features of the project.

RECLAMATION CVPIA LEVEL 4 WILDLIFE REFUGE WATER PURCHASE PROGRAM

Section 3406(d)(1) of the CVPIA[5], Title XXXIV of the Reclamation Projects Authorization and Adjustment Act of 1992 (PL 102-575), requires the Secretary of the Interior (Secretary), immediately upon enactment, to provide firm delivery of Level 2 and 2/3 Full Habitat Development water supplies to the various refuges' habitat areas identified in Reclamation's Refuge Water Supply Report. This report describes water needs and delivery requirements for each wetland habitat area to accomplish stated refuge management objectives. In the Refuge Water Supply Report, historical deliveries were termed Level 2, and the quantity of water needed to achieve full development was termed Level 4. Section 3406(d)(1) of the CVPIA requires the Secretary to provide firm delivery of Level 2 water supplies to each NWR in the Central Valley of California. Section 3406(d)(2) of the CVPIA further directs the Secretary to provide additional water supplies to meet Level 4 needs through the acquisition of water from willing sellers. The water to be acquired is known as Incremental Level 4 supplies. Incremental Level 4 supplies, when added to Level 2 supplies, make up full Level 4 supplies. In recent years, acquired water to meet Level 4 needs has averaged between 70 to 80 TAF.

[5] The CVPIA was signed into law on October 30, 1992, as Title XXXIV of PL 10-575. The CVPIA mandated changes in CVP management, particularly to protect, restore, and enhance fish and wildlife.

11.1.3.2 STATE

CALIFORNIA ENDANGERED SPECIES ACT

Under the CESA (Fish and Game Code Sections 2050 to 2097), California's Fish and Game Commission is responsible for maintaining lists of threatened and endangered species. The CESA prohibits the "take" of listed and candidate (petitioned to be listed) species. "Take" under California law means to "*hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, capture, or kill*" (California Fish and Game Code, Section 86).

CALIFORNIA NATIVE PLANT PROTECTION ACT

The California Native Plant Protection Act (NPPA) contains requirements to preserve, protect, and enhance rare and endangered native plants, in addition to those in the CESA. The definitions of rare and endangered in NPPA differ from those in CESA, but the list of protected native plants encompasses ESA and CESA candidate, threatened, and endangered species. The NPPA also includes restrictions on take, stating that, "*no person shall import into this state, or take, possess, or sell within this state*" any rare or endangered native plant, except as provided in the NPPA. The exception is where landowners have been notified of the presence of protected plants by CDFG. In this case, the landowner is required to notify CDFG at least 11 days in advance of changing land uses to allow CDFG an opportunity to salvage the plants.

CALIFORNIA STATE WETLANDS CONSERVATION POLICY

The Governor of California issued an Executive Order on August 23, 1993, that created a California State Wetlands Conservation Policy. This policy is being implemented by an interagency task force that is jointly headed by the State Resources Agency and the California Environmental Protection Agency (Cal EPA). The policy's three goals (Cylinder *et al.* 1995) are to:

1. Ensure no overall net loss and long-term net gain in wetlands acreage and values in a manner that fosters creativity, stewardship, and respect for private property;
2. Reduce the procedural complexity of state and federal wetland conservation program administration; and
3. Encourage partnerships that make restoration, landowner incentives, and cooperative planning the primary focus of wetlands conservation.

SECTION 1600 *ET SEQ.* OF THE CALIFORNIA FISH AND GAME CODE

CDFG regulates work that will substantially affect resources associated with rivers, streams, and lakes in California, pursuant to Fish and Game Code Sections 1600-1616. Any action that substantially diverts or obstructs the natural flow or substantially changes the bed, channel, or bank of any river, stream or lake or deposits or disposes of any material where it may pass into such a watercourse must be authorized by the CDFG in a Lake or Streambed Alteration Agreement under these statutes. This requirement may, in some cases, apply to any work undertaken within the 100-year floodplain of a body of water or its tributaries, including intermittent streams and desert washes. As a general rule, however, it applies to work done within the annual high-water mark of a wash, stream, or lake that contains or once contained fish or wildlife or that supports or once supported riparian vegetation (JSA 2004).

HABITAT CONSERVATION PLANS

Both the federal ESA and the Natural Community Conservation Planning Act (NCCPA) include provisions for the development of conservation plans to protect vegetation and wildlife resources. A Habitat Conservation Plan (HCP) is designed to offset any harmful effects that a proposed activity might have on a listed species. The HCP process allows development to proceed while promoting listed species conservation. The State of California also includes provisions for the development of conservation plans to protect vegetation and wildlife resources. A Natural Community Conservation Plan (NCCP) *"identifies and provides for the regional or area wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity"* (CDFG Website 2007). There are over 115 HCPs and 15 NCCPs within the State of California that have been approved or are in progress. Because actions associated with the Proposed Project/Action and alternatives are confined to hydrologic systems within the project study area, they would not violate any existing HCP or NCCP. However, Yuba and Sutter counties are currently undertaking creation of a joint NCCP/HCP in connection with improvements to Highways 99 and 70 and future development in the area surrounding those highways (Yuba-Sutter NCCP Homepage Website 2007). A date for completion has not been set.

11.1.3.3 LOCAL

YUBA COUNTY GENERAL PLAN

The Yuba County General Plan does not include an oak or native tree ordinance; however, it does provide guidance for the conservation of open space elements in Yuba County (County of Yuba 1996). Open space elements identified in the general plan include oak woodland, riparian, and wetland habitat and prime agricultural lands.

Vegetation and Wildlife Protection

The Yuba County General Plan identifies open space conservation goals, objectives, and policies for riparian and wetland resources. These guidelines are included in the Vegetation and Wildlife Protection section of the General Plan and include the following goals, which are applicable to the Proposed Project/Action and alternatives (JSA 2004):

- Open Space Conservation Goal (OSCG)-5 – Protect lands of unique value to plants, fisheries, waterfowl, and other forms of animal life.
- Open Space Conservation Objective (OSCO)-17 – No net loss of wetland and riparian habitat.
- OSCO-21 – Identification and protection of remaining areas containing habitat suitable for threatened, endangered, or special-status species.
- Open Space Conservation Policy (OSCP)-77 – Areas adjacent to wildlife areas will be maintained in low-intensity uses, including agriculture, open space, and rural residential.

Conservation of Oak Woodlands

The Yuba County General Plan identifies conservation goals and objectives for oak woodland resources. These guidelines are included in the Conservation of Oak Woodlands section of the

General Plan and include the following goals, which are applicable to the Proposed Project/Action and alternatives (JSA 2004):

- OSCG-7 – Conserve valley oaks and encourage the protection and regeneration of oak woodlands in foothill areas.
- OSCO-27 – Creation of an inventory of remaining valley oaks and development of guidelines for their retention and regeneration.

11.2 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES

11.2.1 IMPACT ASSESSMENT METHODOLOGY

The hydrologic changes associated with implementation of the Proposed Project/Action or an alternative could potentially influence the amount, distribution, and characteristics of riparian and wetland habitats[6] within the study area which, in turn, could potentially affect wildlife species that utilize those habitats for nesting, foraging, protection, and/or roosting. Additionally, these hydrologic changes could potentially affect reservoir fisheries, thereby potentially directly affecting piscivorous bird species that utilize those fisheries.

Quantitative hydrologic modeling served as the primary comparative tool utilized to identify potential impacts associated with each of the alternatives. Operational requirements of the alternatives were modeled by incorporating the Yuba River subbasin module into the CALSIM hydrologic model (see Appendix D). Hydrologic model output was used to compare the predicted end-of-month reservoir water surface elevations (feet msl) and monthly mean instream flows (cfs) for each alternative and bases of comparison. Stage discharge relationships were applied to modeled flows at locations for which those relationships were available. Resultant stage elevation changes were used to evaluate potential impacts on riparian habitats. Potential impacts on special-status plant and wildlife species were inferred based on the evaluation of potential impacts on riparian and reservoir shoreline habitat communities.

A detailed description of the hydrologic model output analysis methodology (i.e., evaluating the frequency, magnitude, and timing of changes in instream flows and reservoir surface water elevation changes) and the types of output associated with these hydrologic model assessments is provided in Chapter 10 and Appendix D.

NEW BULLARDS BAR, OROVILLE, AND SAN LUIS RESERVOIRS

To assess potentially significant impacts on riparian vegetation and associated wildlife species in New Bullards Bar, Oroville, and San Luis reservoirs, long-term average end-of-month water surface elevation, average end-of-month water surface elevation by water year type, and month-by-month end-of-month water surface elevations over the entire 72-year period of record during March through September were evaluated. Modeled reservoir water surface elevations that were considered to be essentially equivalent (i.e., less than 1 foot difference) between each alternative and the basis of comparison were not evaluated further.

[6] Upland terrestrial habitats, Englebright Reservoir shoreline, YCWA service areas, and Delta riparian and wetland communities are excluded from this evaluation based on information presented in Section 11.1.1.1.

Potentially significant impacts on reservoir fisheries (see Section 10.4) were used as indicators to evaluate potential impacts on associated piscivorous bird species.

LOWER YUBA, FEATHER, AND SACRAMENTO RIVERS

To assess potentially significant impacts on riparian vegetation and associated wildlife species in the lower Yuba, Sacramento, and Feather rivers, long-term average monthly flow differences and average monthly flow differences by water year under each alternative, relative to the basis of comparison, during each month from March through September were evaluated. Month-by-month evaluations of monthly mean flow differences that occurred during any individual year for each year of the 72-year model simulation period also were evaluated.

Stage-discharge relationships, where available, were applied to hydrologic model flow results to aid in determining potential flow-related impacts on riparian plant species. Stage-discharge relationships were obtained from the CDEC website in the form of rating tables. Rating tables to the nearest one-hundredth of a foot stage elevation (0.01 foot) were utilized to determine stage elevation associated with a specific discharge at several locations. When modeled flows occurred between two discharges in the rating table, linear interpolation was used to determine the stage to the nearest 0.01 foot associated with each modeled flow. Because changes in stage as small as 0.01 foot would be difficult to measure and would not have any biological meaning, stages utilized for analyses were rounded to the nearest tenth of a foot (0.1 foot). Long-term average stage and average stage by water year type were calculated from mean monthly stages for each water year rather than by converting long-term average flow and average flow by water year type to stage.

Stage differences associated with each alternative, relative to the basis of comparison, that are greater than or equal to one foot and outside the range of stages observed under the basis of comparison were evaluated further. The frequency of stage differences greater than or equal to one foot that occurred outside the range of stages observed under the basis of comparison were used to determine potentially significant impacts associated with instream flow changes on riparian habitats. Additionally, long-term average flow and resultant stage patterns and average flow and stage patterns by water year type from March through September were evaluated for each alternative, relative to the basis of comparison. For example, the frequency of stage elevation differences greater than or equal to one foot between the alternative and the basis of comparison were evaluated along with long-term average flow patterns during March through September to determine the potential of existing riparian resources to be deleteriously inundated or desiccated with sufficient frequency and duration, or exposed to overly stable flows, to degrade the growth, maintenance, and reproductive capacity of riparian vegetation.

Stage-discharge relationships were available for the Yuba River at Smartville and Marysville, the Sacramento River at Keswick and Verona, and the Feather River at Gridley. Because no major accretions or depletions occur in the Feather River between the model node below the Thermalito Afterbay Outlet and the gage at Gridley, the modeled flows in the Feather River at the Thermalito Afterbay Outlet were applied to the Gridley stage-discharge relationship. Impact assessments were conducted for the Feather River at the Thermalito Afterbay Outlet utilizing the assumption that the stage-discharge relationship at Gridley was representative of stage-discharge relationships at the Thermalito Afterbay Outlet. Similarly, no major accretions or depletions occur in the Sacramento River at the confluence with the Feather River and the Verona gage. Therefore, modeled flows from the Sacramento River at the confluence with the Feather River node were applied to the Verona stage-discharge relationship and impact assessments were conducted utilizing the assumption that the stage-discharge relationship at

Verona was representative of the stage-discharge relationship in the Sacramento River at the confluence with the Feather River. Because stage-discharge relationships were available for the Smartville and Marysville model node locations, no further assumptions were necessary for impact assessments to be conducted at those locations.

Potential impacts on riparian communities at model node locations for which stage-discharge relationships were not available were evaluated qualitatively using instream flow model results along with stage elevation information from surrounding model nodes. Generally, channel morphology changes with distance downstream such that channels become wider and less subject to large stage changes. Therefore, utilizing stage-discharge relationships from upstream locations generally would result in a protective analysis at those downstream locations for which stage-stage discharge relationships are not available.

No stage-discharge information was available for the mouth of the Feather River model node location. Therefore, stage differences between the Proposed Project/Action and alternatives, and the bases of comparison at the Thermalito Afterbay Outlet, Yuba River at Marysville, and in the Sacramento River at confluence with the Feather River were utilized as bounds that encompass the range of potential impacts associated with stage changes that could occur at the mouth of the Feather River. Specifically, inflows such as those contributed by Honcut Creek and the Bear River would increase the total Feather River flow at the mouth without the influence of the Proposed Action, thereby attenuating potential stage differences at the mouth of the Feather River caused by operations associated with the Proposed Project/Action and alternatives, relative to stage differences associated with the Proposed Project/Action and alternatives at the Thermalito Afterbay Outlet and Marysville. Additionally, the Feather River widens and increases its meander downstream of the Thermalito Afterbay Outlet, attenuating stage changes associated with given changes in flow. As such, any potential impacts on riparian vegetation associated with the Proposed Project/Action and alternatives would be less than any potential impacts at the Thermalito Afterbay Outlet and in the Yuba River at Marysville.

Additionally, no stage-discharge information was available for the Sacramento River at the Freeport model node location. Therefore, stage differences between the Proposed Project/Action and alternatives, and the bases of comparison at the confluence with the Feather River, were utilized as an upper bound for potential stage differences that could occur at Freeport. Specifically, inflows such as those contributed by the American River would increase the total Sacramento River flow at the Freeport model node location irrespective of the influence of the Proposed Project/Action and alternatives. Therefore, flows associated with the Proposed Project/Action and alternatives represent a smaller proportional contribution to the total flow at Freeport compared to flows in the Sacramento River at the confluence with the Feather River. Additionally, Central Valley rivers typically widen with distance downstream, attenuating potential stage changes associated with given changes in flow. For example, an increase in flow of 170 cfs associated with the Proposed Project/Action and alternatives resulting in an increase in flow from 8,100 cfs to 8,270 cfs would result in a stage change of 0.1 foot at Verona. However, because Freeport is subject to the influence of the American River and the widening of the Sacramento River between the Feather River confluence and Freeport, a 170 cfs increase in flow associated with the Proposed Project/Action and alternatives likely would result in a less than 0.1 foot change in stage. As such, any potential impacts at Freeport would be less than any potential impacts at the confluence with the Feather River.

For purposes of this analysis, stage elevation differences of one foot or greater serve as an indicator value for comparing the Proposed Project/Action and alternatives to the bases of comparison. This indicator value was not meant to serve as a significance threshold, but instead serves as an evaluation guideline for comparative purposes. Differences in the frequency of exceeding the one-foot stage elevation difference between the Proposed Project/Action and alternatives and the basis of comparison will not necessarily constitute an impact. Impact determinations are based on consideration of all evaluated impact indicators.

11.2.2 IMPACT INDICATORS AND SIGNIFICANCE CRITERIA

Potential impacts on terrestrial biological resources would be considered significant if implementation of the Proposed Project/Action or an alternative would result in any of the following:

- Substantial adverse impact on a special-status species, either directly or through habitat modification;
- Substantial adverse impact on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by CDFG or USFWS;
- Substantial adverse impact on federally protected wetlands, as defined by Section 404 of the CWA through direct removal, filling, hydrological interruption, or other means;
- Substantial interference with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or obstruction of native wildlife nursery sites;
- Conflict with any local policies or ordinances protecting biological resources, such as a wetland preservation policy or ordnance; and
- Conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan.

To assist with the quantitative evaluation of potential impacts, impact indicators and significance criteria were developed for use in assessing potential impacts on terrestrial resources (**Table 11-3**).

As discussed in Chapter 4, CEQA and NEPA have different legal and regulatory standards that require slightly different assumptions in the modeling runs used to compare the Proposed Project/Action and alternatives to the appropriate CEQA and NEPA bases of comparison in the impact assessments. Although only one project (the Yuba Accord Alternative) and one action alternative (the Modified Flow Alternative) are evaluated in this EIR/EIS, it is necessary to use separate NEPA and CEQA modeling scenarios for the Proposed Project/Action, alternatives and bases of comparisons to make the appropriate comparisons. As a result, the scenarios compared in the impact assessments below have either a “CEQA” or a “NEPA” prefix before the name of the alternative being evaluated. A detailed discussion of the different assumptions used for the CEQA and NEPA scenarios is included in Appendix D.

As also discussed in Chapter 4, while the CEQA and NEPA analyses in this EIR/EIS refer to “potentially significant,” “less than significant,” “no” and “beneficial” impacts, the first two comparisons (CEQA Yuba Accord Alternative compared to the CEQA No Project Alternative and CEQA Modified Flow Alternative compared to the CEQA No Project Alternative) presented below instead refer to whether or not the proposed change would “unreasonably affect” the evaluated parameter. This is because these first two comparisons are made to determine whether the action alternative would satisfy the requirement of Water Code Section

1736 that the proposed change associated with the action alternative "would not unreasonably affect fish, wildlife, or other instream beneficial uses."

Table 11-3. Impact Indicators and Significance Criteria for the Quantitative Evaluation of Potential Operations-related Effects on Listed Species and Terrestrial Habitats

Life Stage	Evaluation Period	Impact Indicator	Significance Criteria
New Bullards Bar, Oroville, and San Luis Reservoirs			
Native vegetation growing season	March through September	Water surface elevation (feet msl)	Change in reservoir water surface elevation, relative to the basis of comparison, of sufficient magnitude and duration, to degrade continuous strands of native vegetation of relatively high to moderate wildlife value during the extended growing season, for any given month of the evaluation period over the 72-year simulation period.
Piscivorous birds during the nesting season	April through July	Reservoir fishery quality	Change in reservoir fishery, relative to the basis of comparison, of sufficient magnitude and duration, to degrade piscivorous bird forage quantity or quality.
Lower Yuba River			
Native vegetation growing season	March through September	Monthly mean flow (cfs) at the Smartville and Marysville gages	Change in flow, relative to the basis of comparison, of sufficient frequency and magnitude, to degrade the growth, maintenance, and reproductive capacity of the riparian vegetation in the river corridor for any given month of the evaluation period over the 72-year simulation period.
Lower Feather River			
Native vegetation growing season	March through September	Monthly mean flow (cfs) in the Low Flow Channel below the Fish Barrier Dam, in the High Flow Channel below the Thermalito Afterbay Outlet, and at the confluence with the Sacramento River	Change in flow, relative to the basis of comparison, of sufficient frequency and magnitude, to degrade the growth, maintenance, and reproductive capacity of the riparian vegetation in the river corridor for any given month of the evaluation period over the 72-year simulation period.
Lower Sacramento River			
Native vegetation growing season	March through September	Monthly mean flow (cfs) below Keswick Dam, below the confluence with the Feather River, and at Freeport	Change in flow, relative to the basis of comparison, of sufficient frequency and magnitude, to degrade the growth, maintenance, and reproductive capacity of the riparian vegetation in the river corridor for any given month of the evaluation period over the 72-year simulation period.

11.2.3 Environmental Impacts/Environmental Consequences of the CEQA Yuba Accord Alternative Compared to the CEQA No Project Alternative

The potential environmental consequences associated with implementation of the CEQA Yuba Accord Alternative are presented for the communities and piscivorous birds potentially affected by the Proposed Project/Action. Because the assessment methodologies are primarily community based, potential affects on vegetative communities are assumed to also apply to those plant and wildlife species that could potentially utilize or reside within those communities. Therefore, discussions associated with the impacts analyses focus on the habitats inhabited by special-status species identified for full evaluation based on the potential for impacts on those habitats to occur with implementation of the CEQA Yuba Accord Alternative.

Potential impacts on terrestrial biological resources were evaluated utilizing output derived from hydrologic model simulations described in Section 11.2.1 and Section 11.2.2, above. For purposes of this analysis, instream flow differences of 10 percent or greater and stage elevation differences of one foot or greater serve as indicator values for comparing the Proposed Project/Action and alternatives to the bases of comparison. These indicator values are not significance thresholds, but instead are used as evaluation guidelines for comparative purposes. Differences in the frequency of exceeding a particular indicator value between a project alternative and the basis of comparison would not necessarily constitute an impact. Impact determinations are based on consideration of all evaluated impact indicators.

Model simulation instream flow and resultant stage results, as well as model simulation results associated with reservoir water surface elevation, are provided in Appendix F4.

The analytical period associated with terrestrial special-status species is based on the riparian habitat growing season (March through September). Because terrestrial species rarely utilize the lower Yuba, Feather, and Sacramento rivers directly, utilize the rivers infrequently, or are relatively mobile and are able to utilize the rivers regardless of river stage, changes in flows and water temperatures under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, have only limited potential to impact terrestrial species directly. However, implementation of the CEQA Yuba Accord Alternative could potentially impact riparian habitat exclusively or frequently utilized by these species. As such, potential impacts on the species presented in Table 11-1 are inferred based on the potential for riparian habitat to be deleteriously inundated or desiccated with sufficient frequency and duration, or exposed to overly stable flows to impact growth, maintenance, and reproduction of the riparian plant communities. Because riparian plant species are most sensitive to hydrologic changes during the growing season, the analytical period associated with riparian habitat adjacent to the lower Yuba, Feather, and the Sacramento rivers extends from March through September.

Impact 11.2.3-1: Changes in New Bullards Bar Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the CEQA Yuba Accord Alternative is expected to alter New Bullards Bar reservoir water surface elevation, which could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the CEQA Yuba Accord Alternative that would be within the range of water surface elevation fluctuations under the CEQA No Project Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Yuba Accord Alternative are within the range of those under the CEQA No Project Alternative. Additionally, the shoreline of New Bullards Bar Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the CEQA No Project Alternative would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the CEQA Yuba Accord Alternative resulting in end-of-month water surface elevations above those under the CEQA No Project Alternative would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Yuba Accord Alternative generally are slightly lower, ranging from 1 foot lower to 13 feet lower, relative to the CEQA No Project Alternative. Average end-of-month reservoir water surface elevations by water year type also generally are lower under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Specifically, average reservoir water surface elevation ranges from 6 feet higher during dry years to 17 feet lower during above normal years (Appendix F4, 3 vs. 2, pg. 50).

End-of-month New Bullards Bar Reservoir water surface elevations under the CEQA Yuba Accord Alternative would be equivalent to those under the CEQA No Project Alternative approximately 32 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA Yuba Accord Alternative are within the range of those under the CEQA No Project Alternative greater than 98 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Yuba Accord Alternative would be expected to decrease below the lowest end-of-month water surface elevation under the CEQA No Project Alternative less than 2 percent of the time (1 time over the 72-year simulation period during each month from March through August). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the CEQA No Project Alternative during any month of the growing season (Appendix F4, 3 vs. 2, pgs. 56-62).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Yuba Accord Alternative are not expected to substantially impact shoreline vegetation because end-of-month water surface elevations generally are within the range of water surface elevations under the CEQA No Project Alternative. End-of-month water surface elevation decreases below the lowest water surface elevations under the CEQA No Project Alternative would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the CEQA No Project Alternative, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect New Bullards Bar Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.3-2: Changes in the New Bullards Bar Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on New Bullards Bar Reservoir fish species, including bald eagles, could potentially be affected by implementation of the CEQA Yuba Accord Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Yuba Accord Alternative would not unreasonably affect coldwater fisheries and could provide a beneficial impact on warmwater fisheries. The proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown, but likely differs for each bird species. Bird species that forage predominantly on warmwater fish likely would experience an increase in prey availability with implementation of the CEQA Yuba Accord Alternative, while species that forage predominantly on coldwater fish could potentially experience a decrease in prey availability.

Therefore, overall changes in the piscivorous bird forage base in New Bullards Bar Reservoir associated with implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect terrestrial resources.

Impact 11.2.3-3: Changes in lower Yuba River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Yuba Accord Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease the stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Yuba River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Yuba Accord Alternative and the CEQA No Project Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Yuba Accord Alternative that would be within the range of stages observed under the CEQA No Project Alternative would not increase the inundation or desiccation frequency of lower Yuba River riparian habitats.

Although flows and resultant stages under the CEQA Yuba Accord Alternative that would be within the range of those under the CEQA No Project Alternative, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, flow changes that would result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA No Project Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Yuba River.

As such, stage changes resulting from implementation of the CEQA Yuba Accord Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that occur within the range of stages that are expected to occur under the CEQA No Project Alternative, would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Yuba Accord Alternative of 1 foot or more that also would result in stages outside the range of stages observed under the CEQA No Project Alternative could potentially impact riparian habitat along the lower Yuba River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Yuba Accord Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages at Smartville under the CEQA Yuba Accord Alternative generally would be similar, ranging from 0.6 feet higher during August to 0.3 feet lower during May, relative to the CEQA No Project Alternative. Average end-of-month stages by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Specifically, average stages range from 0.7 feet higher during August of below normal years to 0.6 feet lower during May of dry years (Appendix F4, 3 vs. 2, pg. 149).

Monthly average stage decreases of 1 foot or more under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would occur at Smartville 2 times during March and April, and 1 time During May, while a stage increase of 1 foot or more occurs 1 time during April, 2 times during August, and 1 time during September. Stages occurring outside the range of stages observed under the CEQA No Project Alternative would occur 1 time during March through July, and 2 times during August and September. However, no stage differences of 1 foot or more would result in a stage outside the range of stages observed under the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 167-173).

Based on analysis of simulated flows and resultant stages at Smartville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the CEQA Yuba Accord Alternative generally would be similar to those under the CEQA No Project Alternative during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative, indicating that riparian habitat would not be exposed to overly stable flows under the CEQA Yuba Accord Alternative. During dry years, however, flows would have a slightly more stable flow regime under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative.

Analysis of model results indicates that long-term average end-of-month stages at Marysville under the CEQA Yuba Accord Alternative generally would be similar, ranging from 0.5 feet higher during August to 0.2 feet lower during May, relative to the CEQA No Project Alternative. Average end-of-month stages by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Specifically, average stages range from 0.7 feet higher during August of wet, below normal, and dry years to 0.5 feet lower during May of dry years (Appendix F4, 3 vs. 2, pg. 321).

Monthly average stage decreases of 1 foot or more under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would occur at Marysville 1 time during March, while stage increases of 1 foot or more would occur 1 time during July, and 2 times during August. Stages occurring outside the range of stages observed under the CEQA No Project Alternative would occur 1 time during March, 2 times during May, 4 times during June, 2 times during July and August, and 1 time during September. However, no stage differences of 1 foot or more would result in a stage outside the range of stages observed under the CEQA No Project Alternative (Appendix F4, 3 vs. 2, pgs. 339-345).

Based on analysis of simulated flows and resultant stages at Marysville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the CEQA Yuba Accord Alternative generally would be similar to those under the CEQA No Project Alternative during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the CEQA Yuba Accord Alternative and the

CEQA No Project Alternative, indicating that riparian habitat would not be exposed to overly stable flows under the CEQA Yuba Accord Alternative. During dry years, however, flows would have a slightly more stable flow regime under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative.

Model simulations of lower Yuba River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Yuba Accord Alternative outside the range of stages observed under the CEQA No Project Alternative at Smartville or Marysville. Additionally, the pattern of flows and stages among months under the CEQA Yuba Accord Alternative would be similar to those under the CEQA No Project Alternative. Therefore, implementation of the CEQA Yuba Accord Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect riparian habitat adjacent to the Yuba River that may be used by terrestrial resources.

Impact 11.2.3-4: Changes in Oroville Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Because releases from Oroville Reservoir are utilized to meet water quality and quantity requirements in the Delta, in response to water transfers from and flow requirements in the Yuba River, implementation of the CEQA Yuba Accord Alternative could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the CEQA Yuba Accord Alternative that would be within the range of water surface elevation fluctuations under the CEQA No Project Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Yuba Accord Alternative are within the range of those under the CEQA No Project Alternative. Additionally, the shoreline of Oroville Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the CEQA No Project Alternative would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the CEQA Yuba Accord Alternative resulting in end-of-month water surface elevations above those under the CEQA No Project Alternative would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Yuba Accord Alternative generally would be similar, ranging from 1 foot higher to equivalent, relative to the CEQA No Project Alternative. Average end-of-month reservoir water surface elevations by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Specifically, average reservoir water surface elevations would range from 3 feet higher during critical years to 1 foot lower during all other water year types (Appendix F4, 3 vs. 2, pg. 455).

End-of-month Oroville Reservoir water surface elevations under the CEQA Yuba Accord Alternative would be equivalent to those under the CEQA No Project Alternative approximately 74 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA Yuba Accord Alternative would be within the range of those under the CEQA No Project Alternative greater than 99 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Yuba Accord Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the CEQA No Project Alternative less than 1 percent of the time (1 time during each month from March, April, May, and September). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the CEQA No Project Alternative during any month of the growing season (Appendix F4, 3 vs. 2, pgs. 461-467).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Yuba Accord Alternative are not expected to substantially impact shoreline vegetation because end-of-month water surface elevations generally would be within the range of water surface water elevations under the CEQA No Project Alternative. End-of-month water surface elevation decreases below the lowest water surface elevations under the CEQA No Project Alternative would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the CEQA No Project Alternative, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Oroville Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.3-5: Changes in the Oroville Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on Oroville Reservoir fish species, including bald eagles, potentially could be affected by implementation of the CEQA Yuba Accord Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Yuba Accord Alternative would not unreasonably affect the warmwater or coldwater fisheries in Oroville Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in New Oroville Reservoir associated with implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect terrestrial resources.

Impact 11.2.3-6: Changes in lower Feather River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Yuba Accord Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Feather River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Yuba Accord Alternative and the CEQA No Project Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Yuba Accord Alternative that would be within the range of stages observed under the CEQA No Project Alternative would not increase the inundation or desiccation frequency of lower Feather River riparian habitats.

Although flows and resultant stages under the CEQA Yuba Accord Alternative that would be within the range of those under the CEQA No Project Alternative, or are less than 1 foot in magnitude would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA No Project Alternative, flow changes that would result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Yuba Accord Alternative that would be greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA No Project Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Yuba Accord Alternative that would be greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Feather River.

As such, stage changes resulting from implementation of the CEQA Yuba Accord Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that would occur under the CEQA No Project Alternative would not substantially impact riparian habitat. Additionally infrequent stage changes that would be greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Yuba Accord Alternative of 1 foot or more that also would result in stages outside the range of stages observed under the CEQA No Project Alternative could potentially impact riparian habitat along the lower Feather River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Yuba Accord Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Average monthly flows, and resultant stages, in the Feather River below the Fish Barrier Dam would be equivalent under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative for all months and water year types during the riparian habitat analytical period (Appendix F4, 3 vs. 2, pgs. 547-553).

Analysis of model results indicates that long-term average end-of-month stages below the Thermalito Afterbay under the CEQA Yuba Accord Alternative generally would be similar, ranging from 0.1 feet higher during July to 0.2 feet lower during June, relative to the CEQA No Project Alternative. Average end-of-month stages by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative.

Specifically, average stages would range from 0.3 feet higher during July of critical years to 0.3 feet lower during June of critical years (Appendix F4, 3 vs. 2, pg. 652).

Monthly average stage decreases of 1 foot or more under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not occur below the Thermalito Afterbay Outlet while an increase of 1 foot or more would occur 1 time during May. Stages outside the range of stages under the CEQA No Project Alternative would occur 4 times during July (Appendix F4, 3 vs. 2, pgs. 670-676).

Based on analysis of simulated flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative. Specifically, average flows at each location generally would increase and decrease during similar time periods during the growing season, which indicates that riparian habitat would not be exposed to overly stable flows under the CEQA Yuba Accord Alternative. As such, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the CEQA No Project Alternative also would be expected to increase and decrease during those same time periods under the CEQA Yuba Accord Alternative. Because riparian species are adapted to the pattern of floodplain inundation and bench exposure to which they are exposed, and rely on those patterns for successful reproduction, the long-term average flow pattern and flow pattern by water year type under the CEQA Yuba Accord Alternative would not substantially affect riparian species reproduction in the Feather River.

Model simulations of lower Feather River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Yuba Accord Alternative outside the range of stages observed under the CEQA No Project Alternative below the Thermalito Afterbay Outlet. Additionally, the pattern of flows and stages among months under the CEQA Yuba Accord Alternative would be similar to the CEQA No Project Alternative. Therefore, implementation of the CEQA Yuba Accord Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect riparian habitat adjacent to the lower Feather River that may be used by terrestrial resources.

Impact 11.2.3-7: Changes in lower Sacramento River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Yuba Accord Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Sacramento River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Yuba Accord Alternative and the CEQA No Project Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages under the CEQA Yuba Accord Alternative that would be within the range of stages observed under the

CEQA No Project Alternative would not increase the inundation or desiccation frequency of lower Sacramento River riparian habitats.

Although flows and resultant stages under the CEQA Yuba Accord Alternative that would be within the range of those under the CEQA No Project Alternative, or are less than 1 foot in magnitude would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA No Project Alternative, flow changes that would result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Yuba Accord Alternative that would be greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA No Project Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Sacramento River.

As such, stage changes resulting from implementation of the CEQA Yuba Accord Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that would occur under the CEQA No Project Alternative would not substantially impact riparian habitat. Additionally infrequent stage changes that would be greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Yuba Accord Alternative of 1 foot or more that also would result in stages outside the range of stages observed under the CEQA No Project Alternative could potentially impact riparian habitat along the lower Sacramento River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Yuba Accord Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages below the Feather River confluence under the CEQA Yuba Accord Alternative generally would be similar, ranging from 0.2 feet higher during July and August to 0.1 feet lower during May and June, relative to the CEQA No Project Alternative. Average end-of-month stages by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative. Specifically, average stages range from 0.4 feet higher during July of above normal years to 0.3 feet lower during June of critical years (Appendix F4, 3 vs. 2, pg. 931).

Monthly average stage increases or decreases of 1 foot or more under the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not occur below the Feather River confluence. Stages occurring outside the range of stages observed under the CEQA No Project Alternative would occur 2 times during June, 1 time during July and August (Appendix F4, 3 vs. 2, pgs. 949-955).

Based on analysis of simulated flows in the Sacramento River below Feather River confluence and at Freeport, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the CEQA Yuba Accord Alternative and the CEQA No Project Alternative. Specifically, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the CEQA No Project Alternative also would be expected to increase and decrease during those same time periods under the CEQA Yuba Accord Alternative. Therefore, the long-term average flow pattern and flow pattern by water year type under the CEQA Yuba Accord Alternative would not substantially affect riparian species reproduction in the Sacramento River.

Model simulations of lower Sacramento River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Yuba Accord Alternative outside the range of stages observed under the CEQA No Project Alternative below the Feather River confluence. Additionally, the pattern of flows and stages among months under the CEQA Yuba Accord Alternative would be similar to the CEQA No Project Alternative. Therefore, implementation of the CEQA Yuba Accord Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect riparian habitat adjacent to the lower Sacramento River that may be used by terrestrial resources.

Impact 11.2.3-8: Changes in San Luis Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the CEQA Yuba Accord Alternative could alter San Luis Reservoir water surface elevation, which could potentially impact shoreline vegetation and associated listed species. However, water surface elevation fluctuations under the CEQA Yuba Accord Alternative that would be within the range of water surface elevation fluctuations under the CEQA No Project Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Yuba Accord Alternative would be within the range of those under the CEQA No Project Alternative. Unlike most foothill reservoirs, San Luis Reservoir contains gently sloping shoreline upon which riparian vegetation can colonize. Reservoir operations maintain riparian vegetation along the shoreline of San Luis Reservoir perpetually in an early successional stage due to frequent water surface elevation fluctuations. However, water surface elevation reductions resulting in end-of-month water surface elevations below those under the CEQA No Project Alternative would not substantially affect shoreline vegetation because those water surface elevation reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Additionally, reservoir water surface elevation increases under the CEQA Yuba Accord Alternative resulting in end-of-month water surface elevations above those under the CEQA No Project Alternative would be expected to inundate shoreline vegetation. However, under those conditions reservoir operations would continue to maintain riparian habitat in an early successional stage.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Yuba Accord Alternative and No Project Alternative generally would be equivalent. Average end-of-month reservoir water surface elevations by water year type also generally would be equivalent except during dry years, when average water surface elevations generally would be 1 foot to 2 feet lower (Appendix F4, 3 vs. 2, pg. 1413).

End-of-month reservoir water surface elevations under the CEQA Yuba Accord Alternative would be equivalent to those under the CEQA No Project Alternative approximately 93 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA Yuba Accord Alternative would be within the range of those under the CEQA No Project Alternative greater than 99 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Yuba Accord Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the CEQA No Project Alternative less than 1 percent of the time (1 time during August and 2 times during September). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the CEQA No Project Alternative during any month of the growing season (Appendix F4, 3 vs. 2, pgs. 1419-1425)

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Yuba Accord Alternative would not be expected to substantially impact shoreline vegetation because they generally would be within the range of reservoir water surface elevations under the CEQA No Project Alternative. End-of-month water surface elevation decreases below the lowest water surface elevations under the CEQA No Project Alternative would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the CEQA No Project Alternative, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect San Luis Reservoir shoreline riparian vegetation that may be used by terrestrial resources.

Impact 11.2.3-9: Changes in the San Luis Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on San Luis Reservoir fishes potentially could be affected by implementation of the CEQA Yuba Accord Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Yuba Accord Alternative would not unreasonably affect warmwater or coldwater fisheries in San Luis Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in San Luis Reservoir associated with implementation of the CEQA Yuba Accord Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect terrestrial resources.

11.2.4 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE CEQA MODIFIED FLOW ALTERNATIVE COMPARED TO THE CEQA NO PROJECT ALTERNATIVE

The potential environmental consequences associated with implementation of the CEQA Modified Flow Alternative are presented for the communities and piscivorous birds potentially affected by the Proposed Project/Action. Because the assessment methodologies are primarily community based, potential affects on vegetative communities are assumed to also apply to those plant and wildlife species that could potentially utilize or reside within those communities. Therefore, discussions associated with impacts analyses focus on the habitats inhabited by special-status species identified for full evaluation based on the potential for impacts on those habitats to occur with implementation of the CEQA Modified Flow Alternative.

Potential impacts on terrestrial biological resources were evaluated utilizing output derived from hydrologic model simulations described in Section 11.2.1 and Section 11.2.2, above. For purposes of this analysis, instream flow differences of 10 percent or greater and stage elevation differences of one foot or greater serve as indicator values for comparing the project alternatives to the baseline condition. These indicator values are not significance thresholds, but instead are used as evaluation guidelines for comparative purposes. Differences in the frequency of exceeding a particular indicator value between a project alternative and the basis of comparison would not necessarily constitute an impact. Impact determinations are based on consideration of all evaluated impact indicators.

Model simulation instream flow and resultant stage results, as well as model simulation results associated with reservoir water surface elevation are provided in Appendix F4.

The analytical period associated with terrestrial special-status species is based on the riparian habitat growing season (March through September). Because terrestrial species rarely utilize the lower Yuba, Feather, and Sacramento rivers directly, utilize the rivers infrequently, or are relatively mobile and are able to utilize the rivers regardless of river stage, changes in flows and water temperatures under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, have only limited potential to impact terrestrial species directly. However, implementation of the CEQA Modified Flow Alternative could potentially impact riparian habitat exclusively or frequently utilized by these species. As such, potential impacts on the species presented in Table 11-1, above, are inferred based on the potential for riparian habitat to be deleteriously inundated or desiccated with sufficient frequency and duration, or exposed to overly stable flows to impact growth, maintenance, and reproduction of the riparian plant communities. Because riparian plant species are most sensitive to hydrologic changes during the growing season, the analytical period associated with riparian habitat adjacent to the lower Yuba, Feather, and Sacramento rivers extends from March through September.

Impact 11.2.4-1: Changes in New Bullards Bar Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the CEQA Modified Flow Alternative is expected to alter New Bullards Bar reservoir water surface elevation, which could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the CEQA Modified Flow Alternative that would be within the range of water surface elevation fluctuations under the CEQA No Project Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Modified Flow Alternative are within the range of those under the CEQA No Project Alternative. Additionally, the shoreline of New Bullards Bar Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the CEQA No Project Alternative would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the CEQA Modified Flow Alternative resulting in end-of-month water surface elevations above those under the CEQA No Project Alternative would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative generally would be similar, ranging from 4 feet higher to 6 feet lower, relative to the CEQA No Project Alternative. Average end-of-month reservoir water surface elevations by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Specifically, average reservoir water surface elevation ranges from 21 feet higher during critical years to 17 feet lower during above normal years (Appendix F4, 4 vs. 2, pg 50).

End-of-month New Bullards Bar reservoir water surface elevations under the CEQA Modified Flow Alternative would be equivalent to those under the CEQA No Project Alternative approximately 42 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA Modified Flow Alternative are within the range of those under the CEQA No Project Alternative 100 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Modified Flow Alternative would not be expected to decrease below the lowest or increase above the highest end-of-month water surface elevations under the CEQA No Project Alternative during any month of the growing season (Appendix F4, 4 vs. 2, pgs 56-62).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Modified Flow Alternative are not expected to impact shoreline vegetation because end-of-month water surface elevations generally would be similar to those under the CEQA No Project Alternative. Additionally, end-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative and No Project Alternative would not fluctuate outside the range of water surface elevations under the CEQA No Project Alternative, which would not expose additional shoreline or inundate existing shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect New Bullards Bar Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.4-2: Changes in the New Bullards Bar Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on New Bullards Bar Reservoir fish species, including bald eagles, potentially could be affected by implementation of the CEQA Modified Flow Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Modified Flow Alternative would not unreasonably affect coldwater fisheries and could provide a beneficial impact on warmwater fisheries. The proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown, but likely differs for each bird species. Bird species that forage predominantly on warmwater fishes likely would experience an increase in prey availability with implementation of the CEQA Modified Flow Alternative, while species that forage predominantly on coldwater fishes could potentially experience a decrease in prey availability. Therefore, overall changes in the piscivorous bird forage base in New Bullards Bar Reservoir associated with implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect terrestrial resources.

Impact 11.2.4-3: Changes in lower Yuba River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Modified Flow Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Yuba River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Modified Flow Alternative and the CEQA No Project Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Modified Flow Alternative that would be within the range of stages under the CEQA No Project Alternative would not increase the inundation or desiccation frequency of lower Yuba River riparian habitats.

Although flows and resultant stages under the CEQA Modified Flow Alternative that would be within the range of those under the CEQA No Project Alternative, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA No Project Alternative, flow changes that would result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA No Project Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Yuba River.

As such, stage changes resulting from implementation of the CEQA Modified Flow Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that occur within the range of stages that are expected to occur under the CEQA No Project Alternative would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Modified Flow Alternative of 1 foot or more that also would result in stages outside the range of stages observed under the CEQA No Project Alternative could potentially impact riparian habitat along the lower Yuba River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Modified Flow Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages at Smartville under the CEQA Modified Flow Alternative generally would be similar, ranging from 0.5 feet higher during August to 0.3 feet lower during May, relative to the CEQA No Project Alternative. Average end-of-month stages by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Specifically, average stages range from 0.6 feet higher during July of above normal and below normal years and August of wet and above normal years to 0.7 feet lower during May of critical years (Appendix F4, 4 vs. 2, pg 149).

Monthly average stage decreases of 1 foot or more under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would occur at Smartville 1 time during March and April, 11 times during May, and 2 times in June, while a stage increase of 1 foot or more occurs 1 time during March, April, August, and September. Stages occurring outside the range of stages under the CEQA No Project Alternative would occur 1 time during April through July, and 2 times during August and September. In addition, there is 1occurrence where stage differences of 1 foot or more would result in a stage outside the range of stages observed under the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs 167-173).

Based on analysis of simulated flows and resultant stages at Smartville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the CEQA Modified Flow Alternative generally would be similar to those under the CEQA No Project Alternative during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the CEQA Modified Flow Alternative and the CEQA No Project Alternative, indicating that riparian habitat would not be exposed to overly stable flows under the CEQA Modified Flow Alternative. During dry years, however, flows would have a slightly more stable flow regime under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative.

Analysis of model results indicates that long-term average end-of-month stages at Marysville under the CEQA Modified Flow Alternative generally would similar, ranging from 0.4 feet higher during July and August to 0.2 feet lower during May and June, relative to the CEQA No Project Alternative. Average end-of-month stages by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Specifically, average stages range from 0.7 feet higher during July and August of above normal years to 0.8 feet lower during May of critical years (Appendix F4, 4 vs. 2, pg 321).

Monthly average stage decreases of 1 foot or more under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would occur at Marysville 11 times during May, and 3 times during June, while stage increases of 1 foot or more would occur 3 times during July, 2 times during August and 1 time during September. Stages occurring outside the range of stages under the CEQA No Project Alternative would occur 9 times during April, 10 times during May, 18 times during June, 3 times during July, 1 time during August, and 5 times during September. In addition, stage differences of 1 foot or more would result in a stage outside the range of stages 6 times under the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs 339-345).

Based on analysis of simulated flows and resultant stages at Marysville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the CEQA Modified Flow Alternative generally would be similar to those under the CEQA No Project Alternative during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the CEQA Modified Flow Alternative and the CEQA No Project Alternative, indicating that riparian habitat would not be exposed to overly stable flows under the CEQA Modified Flow Alternative. During dry years, however, flows would have a slightly more stable flow regime under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative.

Model simulations of lower Yuba River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Modified Flow Alternative outside the range of stages observed under the CEQA No Project Alternative at Smartville or Marysville. Additionally, the pattern of flows and stages among months under the CEQA Modified Flow Alternative would be similar to those under the CEQA No Project Alternative. Therefore, implementation of the CEQA Modified Flow Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect riparian habitat adjacent to the Yuba River that may be used by terrestrial resources.

Impact 11.2.4-4: Changes in Oroville Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Because releases from Oroville Reservoir are utilized to meet water quality and quantity requirements in the Delta, in response to water transfers from and flow requirements in the Yuba River, implementation of the CEQA Modified Flow Alternative could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the CEQA Modified Flow Alternative that would be within the range of water surface elevation fluctuations under the CEQA No Project Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Modified Flow Alternative are within the range of those under the CEQA No Project Alternative. Additionally, the shoreline of Oroville Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the CEQA No Project Alternative would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the CEQA Modified Flow Alternative resulting in end-of-month water surface elevations above those under the CEQA No Project Alternative would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative generally would be similar, ranging from equivalent to 1 foot lower, relative to the CEQA No Project Alternative. Average end-of-month reservoir water surface elevations by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Specifically, average reservoir water surface elevation ranges from 1 foot higher during above normal and below normal years to 2 feet lower during dry and critical years. Average reservoir water surface elevations under the CEQA Modified Flow Alternative would be equivalent to those under the CEQA No Project Alternative during wet years (Appendix F4, 4 vs. 2, pg 455).

End-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative would be equivalent to those under the CEQA No Project Alternative approximately 83 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA Modified Flow Alternative are within the range of those under the CEQA No Project Alternative approximately 99 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Modified Flow Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the CEQA No Project Alternative about 1 percent of the time (1 time during each month from April through September). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the CEQA No Project Alternative during any month of the growing season (Appendix F4, 4 vs. 2, pgs 461-467).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Modified Flow Alternative are not expected to impact shoreline vegetation because end-of-month water surface elevations generally would be equivalent to those under the CEQA No Project Alternative. Additionally, when end-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative and No Project Alternative are not equivalent, they rarely fluctuate outside the range of water surface elevations under the No Action Alternative, which would infrequently expose additional shoreline. However, because end-of-month water surface elevations do not fluctuate above the highest reservoir water surface elevations under the CEQA No Project Alternative existing shoreline vegetation above the high water mark of the reservoir would not be inundated. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect Oroville Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.4-5: Changes in the Oroville Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on Oroville Reservoir fish species, including bald eagles, potentially could be affected by implementation of the CEQA Modified Flow Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Modified Flow Alternative would not unreasonably affect the warmwater or coldwater fisheries in Oroville Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in Oroville Reservoir associated with implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect terrestrial resources.

Impact 11.2.4-6: Changes in lower Feather River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Modified Flow Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Feather River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Modified Flow Alternative and the CEQA No Project Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Modified Flow Alternative that would be within the range of stages observed under the CEQA No Project Alternative would not increase the inundation or desiccation frequency of lower Feather River riparian habitats.

Although flows and resultant stages under the CEQA Modified Flow Alternative that would be within the range of those under the CEQA No Project Alternative, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA No Project Alternative, flow changes that would result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Modified Flow Alternative that would be greater than or equal to 1 foot in magnitude and would also would result in stages outside the range of those under the CEQA No Project Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Modified Flow Alternative that would be greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Feather River.

As such, stage changes resulting from implementation of the CEQA Modified Flow Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot, that would occur within the range of stages that would occur under the CEQA No Project Alternative would not substantially impact riparian habitat. Additionally, infrequent stage changes that would be greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Modified Flow Alternative of 1 foot or more that also would result in stages outside the range of stages observed under the CEQA No Project Alternative could potentially impact riparian habitat along the lower Feather River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Modified Flow Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Average monthly flows, and resultant stages, in the Feather River below the Fish Barrier Dam would be equivalent under the CEQA Modified Flow Alternative and the CEQA No Project Alternative for all months during the riparian habitat analytical period (Appendix F4, 4 vs. 2, pgs 547-553).

Analysis of model results indicates that long-term average end-of-month stages below the Thermalito Afterbay under the CEQA Modified Flow Alternative generally would be similar, ranging from 0.1 feet higher during April and May to 0.1 feet lower during June, relative to the CEQA No Project Alternative. Average end-of-month stages by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Specifically, average stages would range from 0.2 feet higher during May of critical years to 0.1 feet lower during March and August of below normal years, June of dry and critical years (Appendix F4, 4 vs. 2, pg 652).

Monthly average stage decreases of 1 foot or more under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative would not occur below the Thermalito Afterbay, while stage increases of 1 foot or more would occur 1 time during May. However, stages do not occur outside the range of stages observed under the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs 670-676).

Based on analysis of simulated flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the CEQA Modified Flow Alternative and the CEQA No Project Alternative. Specifically, average flows at each location generally would increase and decrease during similar time periods during the growing season, which indicates that riparian habitat would not be exposed to overly stable flows under the CEQA Modified Flow Alternative. As such, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the CEQA No Project Alternative also would be expected to increase and decrease during those same time periods under the CEQA Modified Flow Alternative. Because riparian species are adapted to the pattern of floodplain inundation and bench exposure to which they are exposed, and rely on those patterns for successful reproduction, the long-term average flow pattern and flow pattern by water year type under the CEQA Modified Flow Alternative would not substantially affect riparian species reproduction in the Feather River.

Model simulations of lower Feather River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Modified Flow Alternative outside the range of stages observed under the CEQA No Project Alternative below the Thermalito Afterbay Outlet. Additionally, the pattern of flows and stages among months under the CEQA Modified Flow Alternative would be similar to the CEQA No Project Alternative. Therefore, implementation of the CEQA Modified Flow Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect riparian habitat adjacent to the lower Feather River that may be used by terrestrial resources.

Impact 11.2.4-7: Changes in lower Sacramento River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Modified Flow Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Sacramento River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Modified Flow Alternative and the CEQA No Project Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Modified Flow Alternative that would be within the range of stages under the CEQA No Project Alternative would not increase the inundation or desiccation frequency of lower Sacramento River riparian habitats.

Although flows and resultant stages under the CEQA Modified Flow Alternative that would be within the range of those under the CEQA No Project Alternative, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA No Project Alternative, flow changes that would result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Modified Flow Alternative that would be greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA No Project Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Sacramento River.

As such, stage changes resulting from implementation of the CEQA Modified Flow Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the CEQA No Project Alternative, would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Modified Flow Alternative of 1 foot or more that also would result in stages outside the range of stages observed under the CEQA No Project Alternative could potentially impact riparian habitat along the lower Sacramento River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Modified Flow Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages below the Feather River confluence under the CEQA Modified Flow Alternative generally would be similar, ranging from 0.1 feet higher during July and August to 0.1 feet lower during June, relative to the CEQA No Project Alternative. Average end-of-month stages by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative. Specifically, average stages range from 0.3 feet higher during July and August of above normal years and August of wet years to 0.3 feet lower during June of critical years (Appendix F4, 4 vs. 2, pg 931).

Monthly average stage increases or decreases of 1 foot or more under the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not occur below the Feather River confluence. Stages occurring outside the range of stages observed under the CEQA No Project Alternative would occur 3 times during June and 1 time during September (Appendix F4, 4 vs. 2, pgs 949-955).

Based on analysis of simulated flows in the Sacramento River below Feather River confluence and at Freeport, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the CEQA Modified Flow Alternative and the CEQA No Project Alternative. Specifically, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the CEQA No Project Alternative also would be expected to increase and decrease during those same time periods under the CEQA Modified Flow Alternative. Therefore, the long-term average flow pattern and flow pattern by water year type under the CEQA Modified Flow Alternative would not substantially affect riparian species reproduction in the Sacramento River.

Model simulations of lower Sacramento River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Modified Flow Alternative outside the range of stages observed under the CEQA No Project Alternative below lower Feather River confluence. Additionally, the pattern of flows and stages among months under the CEQA Modified Flow Alternative would be similar to the CEQA No Project Alternative. Therefore, implementation of the CEQA Modified Flow Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect riparian habitat adjacent to the lower Sacramento River that may be used by terrestrial resources.

Impact 11.2.4-8: Changes in San Luis Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the CEQA Modified Flow Alternative could alter San Luis Reservoir water surface elevation, which could potentially impact shoreline vegetation and associated listed species. However, water surface elevation fluctuations under the CEQA Modified Flow Alternative that would be within the range of water surface elevation fluctuations under the CEQA No Project Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Modified Flow Alternative would be within the range of those under the CEQA No Project Alternative. Unlike most foothill reservoirs, San Luis Reservoir contains gently sloping shoreline upon which riparian vegetation can colonize. Reservoir operations maintain riparian vegetation along the shoreline of San Luis Reservoir perpetually in an early successional stage due to frequent water surface elevation fluctuations. However, water surface elevation reductions resulting in end-of-month water surface elevations below those under the CEQA No Project Alternative would not substantially affect shoreline vegetation because those water surface elevation reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Additionally, reservoir water surface elevation increases under the CEQA Modified Flow Alternative resulting in end-of-month water surface elevations above those under the CEQA No Project Alternative would be expected to inundate shoreline vegetation. However, under those conditions reservoir operations would continue to maintain riparian habitat in an early successional stage.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative and the CEQA No Project Alternative would be equivalent. Average end-of-month reservoir water surface elevations by water year type also would be equivalent under the CEQA Modified Flow Alternative and the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pg 1413).

End-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative would be equivalent to those under the CEQA No Project Alternative approximately 98 percent of the time during all months of the growing season. End-of-month water surface elevations under the CEQA Modified Flow Alternative would be within the range of those under the CEQA No Project Alternative approximately 100 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Modified Flow Alternative would not be expected to decrease below the lowest or increase above the highest end-of-month water surface elevations under the CEQA No Project Alternative (Appendix F4, 4 vs. 2, pgs 1419-1425).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Modified Flow Alternative would not be expected to impact shoreline vegetation because end-of-month water surface elevations generally would be equivalent to those under the CEQA No Project Alternative. Additionally, when end-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative and No Project Alternative are not equivalent, they do not fluctuate outside the range of water surface elevations under the CEQA No Project Alternative, which would not expose additional shoreline or inundate existing shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect San Luis Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.4-9: Changes in the San Luis Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on San Luis Reservoir fishes potentially could be affected by implementation of the CEQA Modified Flow Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Modified Flow Alternative would not unreasonably affect impact warmwater or coldwater fisheries in San Luis Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in San Luis Reservoir associated with implementation of the CEQA Modified Flow Alternative, relative to the CEQA No Project Alternative, would not unreasonably affect terrestrial resources.

11.2.5 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE CEQA YUBA ACCORD ALTERNATIVE COMPARED TO THE CEQA EXISTING CONDITION

Impact 11.2.5-1: Changes in New Bullards Bar Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the CEQA Yuba Accord Alternative is expected to alter New Bullards Bar reservoir water surface elevation, which could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the CEQA Yuba Accord Alternative that would be within the range of water surface elevation fluctuations under the CEQA Existing Condition would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Yuba Accord Alternative are within the range of those under the CEQA Existing Condition. Additionally, the shoreline of New Bullards Bar Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the CEQA Existing Condition would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the CEQA Yuba Accord Alternative resulting in end-of-month water surface elevations above those under the CEQA Existing Condition would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Yuba Accord Alternative generally are lower, ranging from 2 feet lower to 13 feet lower, relative to the CEQA Existing Condition. Average end-of-month reservoir water surface elevations by water year type also generally are lower under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Specifically, average reservoir water surface elevation ranges from 8 feet higher during above normal years to 30 feet lower during critical years (Appendix F4, 3 vs. 1, pg 50).

End-of-month reservoir water surface elevations under the CEQA Yuba Accord Alternative would be equivalent to those under the CEQA Existing Condition approximately 33 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA Yuba Accord Alternative are within the range of those under the CEQA Existing Condition greater than 98 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Yuba Accord Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the CEQA Existing Condition less than 2 percent of the time (1 time during each month). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the CEQA Existing Condition during any month of the growing season (Appendix F4, 3 vs. 1, pgs 56-62).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Yuba Accord Alternative are not expected to substantially impact shoreline vegetation because end-of-month water surface elevations generally are within the range of water surface water elevations under the CEQA Existing Condition. End-of-month water surface elevation decreases below the lowest water surface elevations under the CEQA Existing Condition would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the No Project Alternative, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on New Bullards Bar Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.5-2: Changes in the New Bullards Bar Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on New Bullards Bar Reservoir fish species, including bald eagles, potentially could be affected by implementation of the CEQA Yuba Accord Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Yuba Accord Alternative would not significantly impact the warmwater or coldwater fisheries. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in New Bullards Bar Reservoir associated with implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on terrestrial resources.

Impact 11.2.5-3: Changes in lower Yuba River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Yuba Accord Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Yuba River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Yuba Accord Alternative and the CEQA Existing Condition are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Yuba Accord Alternative that would be within the range of stages under the CEQA Existing Condition would not increase the inundation or desiccation frequency of lower Yuba River riparian habitats.

Although flows and resultant stages under the CEQA Yuba Accord Alternative that would be within the range of those under the CEQA Existing Condition, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA Existing Condition, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA Existing Condition could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Yuba River.

As such, stage changes resulting from implementation of the CEQA Yuba Accord Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the CEQA Existing Condition would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Yuba Accord Alternative of 1 foot or more that also would result in stages outside the range of stages under the CEQA Existing Condition could potentially impact riparian habitat along the lower Yuba River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Yuba Accord Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages at Smartville under the CEQA Yuba Accord Alternative generally would be similar, ranging from 0.2 feet higher during April and June to 0.2 feet lower during July, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Specifically, average stages range from 0.4 feet higher during April, June, and September of critical years to 0.5 feet lower during August of above normal years (Appendix F4, 3 vs. 1, pg 149).

Monthly average stage decreases of 1 foot or more under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would occur at Smartville 3 times during March, 1 times during April, 3 times during July, and 3 times during August, while a stage increase of 1 foot or more would occur 2 times during April and May, and 4 times during June. Stages occurring outside the range of stages under the CEQA Existing Condition would occur 1 times during March through July, 2 times during August, and 1times during September. In addition, there would be 2 occurrences where stage differences of 1 foot or more would result in a stage outside the range of stages under the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs. 167-173).

Based on analysis of simulated flows and resultant stages at Smartville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the CEQA Yuba Accord Alternative generally would be similar to those under the CEQA Existing Condition during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the CEQA Yuba Accord Alternative and the CEQA Existing Condition, indicating that riparian habitat would not be exposed to overly stable flows under the CEQA Yuba Accord Alternative. During dry years, however, flows would have a slightly more stable flow regime under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition.

Analysis of model results indicates that long-term average end-of-month stages at Marysville under the CEQA Yuba Accord Alternative generally would be similar, ranging from 0.1 feet higher during June and September to 0.3 feet lower during July, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Specifically, average stages range from 0.5 feet higher during May and June of critical years to 0.7 feet lower during July and August of above normal years (Appendix F4, 3 vs. 1, pg 321).

Monthly average stage decreases of 1 foot or more under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition would occur at Marysville 3 times during March and July, and 4 times during August, while stage increases of 1 foot or more would occur 2 times during May and June, and 1 times during August. Stages occurring outside the range of stages under the CEQA Existing Condition would occur 1 time during March and July, 2 times during August, and 1 time during September. However, no stage differences of 1 foot or more would result in a stage outside the range of stages under the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs 339-345).

Based on analysis of simulated flows and resultant stages at Marysville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the CEQA Yuba Accord Alternative generally would be similar to those under the CEQA Existing Condition during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the CEQA Yuba Accord Alternative and the CEQA Existing Condition, indicating that riparian habitat would not be exposed to overly stable flows under the CEQA Yuba Accord Alternative. During dry years, however, flows would have a slightly more stable flow regime under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition.

Model simulations of lower Yuba River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Yuba Accord Alternative outside the range of stages under the CEQA Existing Condition at Smartville or Marysville. Additionally, the pattern of flows and stages among months under the CEQA Yuba Accord Alternative would be similar to the CEQA Existing Condition. Therefore, implementation of the CEQA Yuba Accord Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would be expected to have a less than significant impact on riparian habitat adjacent to the Yuba River that may be used by terrestrial resources.

Impact 11.2.5-4: Changes in Oroville Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Because releases from Oroville Reservoir are utilized to meet water quality and quantity requirements in the Delta, in response to water transfers from and flow requirements in the Yuba River, implementation of the CEQA Yuba Accord Alternative could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the CEQA Yuba Accord Alternative that would be within the range of water surface elevation fluctuations under the CEQA Existing Condition would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Yuba Accord Alternative are within the range of those under the CEQA Existing Condition. Additionally, the shoreline of Oroville Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the CEQA Existing Condition would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the CEQA Yuba Accord Alternative resulting in end-of-month water surface elevations above those under the CEQA Existing Condition would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Yuba Accord Alternative generally would be similar, ranging from 1 foot higher to equivalent, relative to the CEQA Existing Condition. Average end-of-month reservoir water surface elevations by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Specifically, average reservoir water surface elevation ranges from 3 feet higher during critical years to 1 foot lower during wet, above normal, and below normal years (Appendix F4, 3 vs. 1, pg 455).

End-of-month reservoir water surface elevations under the CEQA Yuba Accord Alternative would be equivalent to those under the CEQA Existing Condition approximately 71 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA Yuba Accord Alternative are within the range of those under the CEQA Existing Condition greater than 99 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Yuba Accord Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the CEQA Existing Condition less than 1 percent of the time (1 time during March). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the CEQA Existing Condition during any month of the growing season (Appendix F4, 3 vs. 1, pgs 461-467).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Yuba Accord Alternative are not expected to substantially impact shoreline vegetation because end-of-month water surface elevations generally are within the range of water surface water elevations under the CEQA Existing Condition. End-of-month water surface elevation decreases below the lowest water surface elevations under the CEQA Existing Condition would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the CEQA Existing Condition, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Oroville Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.5-5: Changes in the Oroville Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on Oroville Reservoir fish species, including bald eagles, could be affected by implementation of the CEQA Yuba Accord Alternative because potential impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Yuba Accord Alternative would not significantly impact the warmwater or coldwater fisheries in Oroville Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in Oroville Reservoir associated with implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on terrestrial resources.

Impact 11.2.5-6: Changes in lower Feather River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Yuba Accord Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Feather River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Yuba Accord Alternative and the CEQA Existing Condition are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Yuba Accord Alternative that would be within the range of stages under the CEQA Existing Condition would not increase the inundation or desiccation frequency of lower Feather River riparian habitats.

Although flows and resultant stages under the CEQA Yuba Accord Alternative that would be within the range of those under the CEQA Existing Condition, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA Existing Condition, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA Existing Condition could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Feather River.

As such, stage changes resulting from implementation of the CEQA Yuba Accord Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the CEQA Existing Condition would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Yuba Accord Alternative of 1 foot or more that also would result in stages outside the range of stages under the CEQA Existing Condition could potentially impact riparian habitat along the lower Feather River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Yuba Accord Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Average monthly flows, and resultant stages, in the Feather River below the Fish Barrier Dam would be equivalent under the CEQA Yuba Accord Alternative and the CEQA Existing Condition for all months during the riparian habitat analytical period (Appendix F4, 3 vs. 1, pgs 547-553).

Analysis of model results indicates that long-term average end-of-month stages below the Thermalito Afterbay Outlet under the CEQA Yuba Accord Alternative generally would be similar, ranging from 0.1 feet higher during June to 0.1 feet lower during March through June, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Specifically, average stages range from 0.3 feet higher during July of critical years to 0.2 feet lower during June of critical years (Appendix F4, 3 vs. 1, pg 6052 Afterbay Outlet. Stages occurring outside the range of stages under the CEQA Existing Condition would occur 4 times during July and 1 time during August (Appendix F4, 3 vs. 1, pgs 670-676).

Based on analysis of simulated flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the CEQA Yuba Accord Alternative and the CEQA Existing Condition. Specifically, average flows at each location generally increase and decrease during similar time periods during the growing season, which indicates that riparian habitat would not be exposed to overly stable flows under the CEQA Yuba Accord Alternative. As such, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the CEQA Existing Condition also would be expected to increase and decrease during those same time periods under the CEQA Yuba Accord Alternative. Because riparian species are adapted to the pattern of floodplain inundation and bench exposure to which they are exposed, and rely on those patterns for successful reproduction, the long-term average flow pattern and flow pattern by water year type under the CEQA Yuba Accord Alternative would not substantially affect riparian species reproduction in the Feather River.

Model simulations of lower Feather River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Yuba Accord Alternative outside the range of stages under the CEQA Existing Condition below the Thermalito Afterbay Outlet. Additionally, the pattern of flows and stages among months under the CEQA Yuba Accord Alternative would be similar to the CEQA Existing Condition. Therefore, implementation of the CEQA Yuba Accord Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would be expected to have a less than significant impact on riparian habitat adjacent to the lower Feather River that may be used by terrestrial resources.

Impact 11.2.5-7: Changes in lower Sacramento River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Yuba Accord Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Sacramento River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Yuba Accord Alternative and the CEQA Existing Condition are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Yuba Accord Alternative that would be within the range of stages under the CEQA Existing Condition would not increase the inundation or desiccation frequency of lower Sacramento River riparian habitats.

Although flows and resultant stages under the CEQA Yuba Accord Alternative that would be within the range of those under the CEQA Existing Condition, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA Existing Condition, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA Existing Condition could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Sacramento River.

As such, stage changes resulting from implementation of the CEQA Yuba Accord Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the CEQA Existing Condition would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Yuba Accord Alternative of 1 foot or more that also would result in stages outside the range of stages under the CEQA Existing Condition could potentially impact riparian habitat along the lower Sacramento River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Yuba Accord Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages below the Feather River confluence under the CEQA Yuba Accord Alternative generally would be similar, ranging from equivalent to 0.1 feet lower during March and May, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Specifically, average stages range from 0.2 feet higher during July of critical years to 0.3 feet lower during August of above normal years (Appendix F4, 3 vs. 1, pg 931).

Monthly average stage decreases of 1 foot or more under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would occur below the Feather River confluence 1 time during March, while stage increases of 1 foot or more would not occur below the Feather River confluence. Stages occurring outside the range of stages under the CEQA Existing Condition would occur 1 time during March, July, and August. However, no stage differences of 1 foot or more would result in a stage outside the range of stages under the CEQA Existing Condition (Appendix F4, 3 vs. 1, pgs 949-955).

Based on analysis of simulated flows in the Sacramento River below Feather River confluence and at Freeport, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the CEQA Yuba Accord Alternative and the CEQA Existing Condition. Specifically, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the CEQA Existing Condition also would be expected to increase and decrease during those same time periods under the CEQA Yuba Accord Alternative. Therefore, the long-term average flow pattern and flow pattern by water year type under the CEQA Yuba Accord Alternative would not substantially affect riparian species reproduction in the Sacramento River.

Model simulations of lower Sacramento River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Yuba Accord Alternative outside the range of stages under the CEQA Existing Condition below the Feather River confluence. Additionally, the pattern of flows and stages among months under the CEQA Yuba Accord Alternative would be similar to the CEQA Existing Condition. Therefore, implementation of the CEQA Yuba Accord Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would be expected to have a less than significant impact on riparian habitat adjacent to the lower Sacramento River that may be used by terrestrial resources.

Impact 11.2.5-8: Changes in San Luis Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the CEQA Yuba Accord Alternative could alter San Luis Reservoir water surface elevation, which could potentially impact shoreline vegetation and associated listed species. However, water surface elevation fluctuations under the CEQA Yuba Accord Alternative that would be within the range of water surface elevation fluctuations under the CEQA Existing Condition would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Yuba Accord Alternative are within the range of those under the CEQA Existing Condition. Unlike most foothill reservoirs, San Luis Reservoir contains gently sloping shoreline upon which riparian vegetation can colonize. Reservoir operations maintain riparian vegetation along the shoreline of San Luis Reservoir perpetually in an early successional stage due to frequent water surface elevation fluctuations. However, water surface elevation reductions resulting in end-of-month water surface elevations below those under the CEQA Existing Condition would not substantially affect shoreline vegetation because those water surface elevation reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Additionally, reservoir water surface elevation increases under the CEQA Yuba Accord Alternative resulting in end-of-month water surface elevations above those under the CEQA Existing Condition would be expected to inundate shoreline vegetation. However, under those conditions reservoir operations would continue to maintain riparian habitat in an early successional stage.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Yuba Accord Alternative generally would be similar, ranging from equivalent to 1 foot lower, relative to the CEQA Existing Condition. Average end-of-month reservoir water surface elevations by water year type also generally would be similar under the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition. Specifically, average reservoir water surface elevation generally is equivalent except during dry years, when average water surface elevations generally range from 1 foot to 2 feet lower (Appendix F4, 3 vs. 1, pg 1413).

End-of-month reservoir water surface elevations under the CEQA Yuba Accord Alternative would be equivalent to those under the CEQA Existing Condition approximately 94 percent of the time during all months of the growing season. End-of-month water surface elevations under the CEQA Yuba Accord Alternative are within the range of those under the CEQA Existing Condition greater than 99 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Yuba Accord Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the CEQA Existing Condition less than 1 percent of the time (1 time during August and 2 times during September). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the CEQA Existing Condition during any month of the growing season (Appendix F4, 3 vs. 1, pgs 1419-1425).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Yuba Accord Alternative are not expected to substantially impact native shoreline vegetation because they generally are within the range of water surface water elevations under the CEQA Existing Condition. End-of-month water surface elevation decreases below the lowest water surface elevations under the CEQA Existing Condition would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest water surface elevations under the CEQA Existing Condition, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on San Luis Reservoir shoreline riparian vegetation that may be used by terrestrial resources.

Impact 11.2.5-9: Changes in the San Luis Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on San Luis Reservoir fishes potentially could be affected by implementation of the CEQA Yuba Accord Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Yuba Accord Alternative would not significantly impact warmwater or coldwater fisheries in San Luis Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in San Luis Reservoir associated with implementation of the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on terrestrial resources.

11.2.6 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE CEQA MODIFIED FLOW ALTERNATIVE COMPARED TO THE CEQA EXISTING CONDITION

Impact 11.2.6-1: Changes in New Bullards Bar Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the CEQA Modified Flow Alternative is expected to alter New Bullards Bar reservoir water surface elevation, which could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the CEQA Modified Flow Alternative that would be within the range of water surface elevation fluctuations under the CEQA Existing Condition would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Modified Flow Alternative are within the range of those under the CEQA Existing Condition. Additionally, the shoreline of New Bullards Bar Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the CEQA Existing Condition would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the CEQA Modified Flow Alternative resulting in end-of-month water surface elevations above those under the CEQA Existing Condition would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative generally would be similar, ranging from 4 feet higher to equivalent, relative to the CEQA Existing Condition. Average end-of-month reservoir water surface elevations by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Specifically, average reservoir water surface elevation ranges from 8 feet higher during above normal years to 1 foot lower during all other water year types (Appendix F4, 4 vs. 1, pg 50).

End-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative would be equivalent to those under the CEQA Existing Condition approximately 40 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA Modified Flow Alternative are within the range of those under the CEQA Existing Condition greater than 98 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Modified Flow Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the CEQA Existing Condition less than 2 percent of the time (1 time during each month from March through August). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the CEQA Existing Condition during any month of the growing season (Appendix F4, 4 vs. 1, pgs 56-62).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Modified Flow Alternative are not expected to substantially impact shoreline vegetation because end-of-month water surface elevations generally are within the range of water surface water elevations under the CEQA Existing Condition. End-of-month water surface elevation decreases below the lowest water surface elevations under the CEQA Existing Condition would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the No Project Alternative, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on New Bullards Bar Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.6-2: Changes in the New Bullards Bar Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on New Bullards Bar Reservoir fish species, including bald eagles, could potentially be affected by implementation of the CEQA Modified Flow Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Modified Flow Alternative would not significantly impact the warmwater or coldwater fisheries. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in New Bullards Bar Reservoir associated with implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on terrestrial resources.

Impact 11.2.6-3: Changes in lower Yuba River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Modified Flow Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Yuba River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Modified Flow Alternative and the CEQA Existing Condition are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Modified Flow Alternative that would be within the range of stages under the CEQA Existing Condition would not increase the inundation or desiccation frequency of lower Yuba River riparian habitats.

Although flows and resultant stages under the CEQA Modified Flow Alternative that would be within the range of those under the CEQA Existing Condition, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA Existing Condition, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA Existing Condition could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Yuba River.

As such, stage changes resulting from implementation of the CEQA Modified Flow Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the CEQA Existing Condition would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Modified Flow Alternative of 1 foot or more that also would result in stages outside the range of stages under the CEQA Existing Condition could potentially impact riparian habitat along the lower Yuba River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Modified Flow Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages at Smartville under the CEQA Modified Flow Alternative generally would be similar, ranging from 0.1 feet higher during April and June to 0.1 feet lower during March, and July through August, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Specifically, average stages ranges from 0.2 feet higher during April of below normal years to 0.3 feet lower during August of above normal years (Appendix F4, 4 vs. 1, pg 149).

Monthly average stage decreases of 1 foot or more under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would occur at Smartville 1 time during March, while a stage increase of 1 foot or more does not occur. Stages occurring outside the range of stages under the CEQA Existing Condition would occur 1 time during April through July, 2 times in August, and 1 time in September. However, no stage differences of 1 foot or more would result in a stage outside the range of stages under the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs 167-173).

Based on analysis of simulated flows and resultant stages at Smartville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the CEQA Modified Flow Alternative generally would be similar to those under the CEQA Existing Condition during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the CEQA Modified Flow Alternative and the CEQA Existing Condition, indicating that riparian habitat would not be exposed to overly stable flows under the CEQA Modified Flow Alternative. During dry years, however, flows would have a slightly more stable flow regime under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition.

Analysis of model results indicates that long-term average end-of-month stages at Marysville under the CEQA Modified Flow Alternative generally would be similar, ranging from equivalent during March, April, and May to 0.2 feet lower during July and August, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Specifically, average stages ranges from 0.1 feet higher during July of critical years to 0.4 feet lower during July and August of above normal years and July of below normal years (Appendix F4, 4 vs. 1, pg 321).

Monthly average stage decreases of 1 foot or more under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would occur at Marysville 1 time during March, and 2 times during July, while stage increases of 1 foot or more would not occur. Stages occurring outside the range of stages under the CEQA Existing Condition would occur 1 time during July through September. However, no stage differences of 1 foot or more would result in a stage outside the range of stages under the CEQA Existing Condition (Appendix F4, 4 vs. 1, pgs 339-345).

Based on analysis of simulated flows and resultant stages at Marysville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the CEQA Modified Flow Alternative generally would be similar to those under the CEQA Existing Condition during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the CEQA Modified Flow Alternative and the CEQA Existing Condition, indicating that riparian habitat would not be exposed to overly stable flows under the CEQA Modified Flow Alternative. During dry years, however, flows would have a slightly more stable flow regime under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition.

Model simulations of lower Yuba River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Modified Flow Alternative outside the range of stages under the CEQA Existing Condition at Smartville or Marysville. Additionally, the pattern of flows and stages among months under the CEQA Modified Flow Alternative would be similar to those under the CEQA Existing Condition. Therefore, implementation of the CEQA Modified Flow Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would be expected to have a less than significant impact on riparian habitat adjacent to the Yuba River that may be used by terrestrial resources.

Impact 11.2.6-4: Changes in Oroville Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Because releases from Oroville Reservoir are utilized to meet water quality and quantity requirements in the Delta, in response to water transfers from and flow requirements in the Yuba River, implementation of the CEQA Modified Flow Alternative could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the CEQA Modified Flow Alternative that would be within the range of water surface elevation fluctuations under the CEQA Existing Condition would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA Modified Flow Alternative are within the range of those under the CEQA Existing Condition. Additionally, the shoreline of Oroville Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the CEQA Existing Condition would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the CEQA Modified Flow Alternative resulting in end-of-month water surface elevations above those under the CEQA Existing Condition would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative would be equivalent to those under the CEQA Existing Condition. Average end-of-month reservoir water surface elevations by water year type generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Specifically, average reservoir water surface elevation ranges from 1 foot higher during below normal years to 1 foot lower during wet, dry, and critical years (Appendix F4, 4 vs. 1, pg 455).

End-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative would be equivalent to those under the CEQA Existing Condition approximately 82 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA Modified Flow Alternative are within the range of those under the CEQA Existing Condition greater than 99 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Modified Flow Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the CEQA Existing Condition less than 1 percent of the time (1 time during July, August, and September). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the CEQA Existing Condition during any month of the growing season (Appendix F4, 4 vs. 1, pgs 461-467).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Modified Flow Alternative are not expected to substantially impact shoreline vegetation because end-of-month water surface elevations generally are within the range of water surface water elevations under the CEQA Existing Condition. End-of-month water surface elevation decreases below the lowest water surface elevations under the CEQA Existing Condition would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the CEQA Existing Condition, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on Oroville Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.6-5: Changes in the Oroville Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on Oroville Reservoir fish species, including bald eagles, potentially could be affected by implementation of the CEQA Modified Flow Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Modified Flow Alternative would not significantly impact the warmwater or coldwater fisheries in Oroville Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in Oroville Reservoir associated with implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on terrestrial resources.

Impact 11.2.6-6: Changes in lower Feather River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Modified Flow Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Feather River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Modified Flow Alternative and the CEQA Existing Condition are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Modified Flow Alternative that would be within the range of stages under the CEQA Existing Condition would not increase the inundation or desiccation frequency of lower Feather River riparian habitats.

Although flows and resultant stages under the CEQA Modified Flow Alternative that would be within the range of those under the CEQA Existing Condition, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA Existing Condition, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA Existing Condition could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Feather River.

As such, stage changes resulting from implementation of the CEQA Modified Flow Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the CEQA Existing Condition would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Modified Flow Alternative of 1 foot or more that also would result in stages outside the range of stages under the CEQA Existing Condition could potentially impact riparian habitat along the lower Feather River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Modified Flow Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Average monthly flows, and resultant stages, in the Feather River below the Fish Barrier Dam would be equivalent under the CEQA Modified Flow Alternative and the CEQA Existing Condition for all months during the riparian habitat analytical period (Appendix F4, 4 vs. 1, pgs 547-553).

Analysis of model results indicates that long-term average end-of-month stages below the Thermalito Afterbay under the CEQA Modified Flow Alternative generally would be similar, ranging from equivalent to 0.1 feet lower during March, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition.

Specifically, average stages ranges from 0.1 feet higher during September of below normal years to 0.1 feet lower during March of below normal years (Appendix F4, 4 vs. 1, pg 652).

Monthly average stage increases or decreases of 1 foot or more under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition would not occur below the Thermalito Afterbay Outlet. In addition, stages outside the range of stages under the CEQA Existing Condition also would not occur (Appendix F4, 4 vs. 1, pgs 670-676).

Based on analysis of simulated flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the CEQA Modified Flow Alternative and the CEQA Existing Condition. Specifically, average flows at each location generally increase and decrease during similar time periods during the growing season, which indicates that riparian habitat would not be exposed to overly stable flows under the CEQA Modified Flow Alternative. As such, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the CEQA Existing Condition also would be expected to increase and decrease during those same time periods under the CEQA Modified Flow Alternative. Because riparian species are adapted to the pattern of floodplain inundation and bench exposure to which they are exposed, and rely on those patterns for successful reproduction, the long-term average flow pattern and flow pattern by water year type under the CEQA Modified Flow Alternative would not substantially affect riparian species reproduction in the Feather River.

Model simulations of lower Feather River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Modified Flow Alternative outside the range of stages under the CEQA Existing Condition below the Thermalito Afterbay Outlet. Additionally, the pattern of flows and stages among months under the CEQA Modified Flow Alternative would be similar to those under the CEQA Existing Condition. Therefore, implementation of the CEQA Modified Flow Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would be expected to have a less than significant impact on riparian habitat adjacent to the lower Feather River that may be used by terrestrial resources.

Impact 11.2.6-7: Changes in lower Sacramento River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA Modified Flow Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Sacramento River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA Modified Flow Alternative and the CEQA Existing Condition are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA Modified Flow Alternative that would be within the range of stages under the CEQA

Existing Condition would not increase the inundation or desiccation frequency of lower Sacramento River riparian habitats.

Although flows and resultant stages under the CEQA Modified Flow Alternative that would be within the range of those under the CEQA Existing Condition, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA Existing Condition, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA Existing Condition could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Sacramento River.

As such, stage changes resulting from implementation of the CEQA Modified Flow Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the CEQA Existing Condition would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA Modified Flow Alternative of 1 foot or more that also would result in stages outside the range of stages under the CEQA Existing Condition could potentially impact riparian habitat along the lower Sacramento River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA Modified Flow Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages below the Feather River confluence under the CEQA Modified Flow Alternative generally would be similar, ranging from equivalent during April through June and September to 0.1 feet lower during March, July, and August, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition. Specifically, average stages range from equivalent to 0.2 feet lower during July of wet years, and July and August of above normal years (Appendix F4, 4 vs. 1, pg 931).

Monthly average stage increases or decreases of 1 foot or more under the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would not occur below the Feather River confluence. Stages occurring outside the range of stages under the CEQA Existing Condition would occur 1 time during March and July (Appendix F4, 4 vs. 1, pgs 949-955).

Based on analysis of simulated flows in the Sacramento River below Feather River confluence and at Freeport, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the CEQA Modified Flow Alternative and the CEQA Existing Condition. Specifically, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the CEQA Existing Condition also would be expected to increase and decrease during those same time periods under the CEQA Modified Flow Alternative. Therefore, the long-term average flow pattern and flow pattern by water year type under the CEQA Modified Flow Alternative would not substantially affect riparian species reproduction in the Sacramento River.

Model simulations of lower Sacramento River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA Modified Flow Alternative outside the range of stages under the CEQA Existing Condition below the Feather River confluence. Additionally, the pattern of flows and stages among months under the CEQA Modified Flow Alternative would be similar to those under the CEQA Existing Condition. Therefore, implementation of the CEQA Modified Flow Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would be expected to have a less than significant impact on riparian habitat adjacent to the lower Sacramento River that may be used by terrestrial resources.

Impact 11.2.6-8: Changes in San Luis Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the CEQA Modified Flow Alternative could alter San Luis Reservoir water surface elevation, which could potentially impact shoreline vegetation and associated listed species. However, surface elevation fluctuations under the CEQA Modified Flow Alternative that would be within the range of surface elevation fluctuations under the CEQA Existing Condition would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir surface elevation fluctuations under the CEQA Modified Flow Alternative are within the range of those under the CEQA Existing Condition. Unlike most foothill reservoirs, San Luis Reservoir contains gently sloping shoreline upon which riparian vegetation can colonize. Reservoir operations maintain riparian vegetation along the shoreline of San Luis Reservoir perpetually in an early successional stage due to frequent surface elevation fluctuations. However, surface elevation reductions resulting in end-of-month surface elevations below those under the CEQA Existing Condition would not substantially affect shoreline vegetation because those water surface elevation reductions would expose typically inundated shoreline and would not dewater existing terrestrial vegetation. Additionally, reservoir water surface elevation increases under the CEQA Modified Flow Alternative resulting in end-of-month surface elevations above those under the CEQA Existing Condition would be expected to inundate shoreline vegetation. However, under those conditions reservoir operations would continue to maintain riparian habitat in an early successional stage.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA Modified Flow Alternative and the CEQA Existing Condition would be equivalent. Average end-of-month reservoir surface elevations by water year type also would be equivalent (Appendix F4, 4 vs. 1, pg 1413).

End-of-month reservoir surface elevations under the CEQA Modified Flow Alternative would be equivalent to those under the CEQA Existing Condition approximately 99 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA Modified Flow Alternative are within the range of those under the CEQA Existing Condition greater than 100 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA Modified Flow Alternative would not be expected to decrease below the lowest or increase above the highest end-of-month water surface elevations under the CEQA Existing Condition during any month of the growing season (Appendix F4, 4 vs. 1, pgs 1419-1425).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA Modified Flow Alternative are not expected to impact native shoreline vegetation because end-of-month surface elevations generally would be equivalent to those under the CEQA Existing Condition. Additionally, end-of-month reservoir water surface elevations would not fluctuate outside the range of reservoir water surface elevations under the CEQA Existing Condition, which would not expose additional shoreline or inundate existing shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on San Luis Reservoir shoreline riparian vegetation that may be used by terrestrial resources.

Impact 11.2.6-9: Changes in the San Luis Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on San Luis Reservoir fishes potentially could be affected by implementation of the CEQA Modified Flow Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA Modified Flow Alternative would not significantly impact warmwater or coldwater fisheries in San Luis Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in San Luis Reservoir associated with implementation of the CEQA Modified Flow Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on terrestrial resources.

11.2.7 Environmental Impacts/Environmental Consequences of the CEQA No Project/NEPA No Action Alternative Compared to the CEQA Existing Condition/NEPA Affected Environment

As discussed in Chapter 3, the key elements and activities (e.g., implementation of the RD-1644 Long-term instream flow requirements) for the CEQA No Project Alternative would be the same for the NEPA No Action Alternative. The primary differences between the CEQA No Project and NEPA No Action alternatives are various hydrologic and other modeling assumptions (see Section 4.5 and Appendix D). Because of these differences between the No Project and No Action alternatives, these alternatives are distinguished as separate alternatives for CEQA and NEPA evaluation purposes.

Based on current plans and consistent with available infrastructure and community services, the CEQA No Project Alternative in this EIR/EIS is based on current environmental conditions (e.g., project operations, water demands, and level of land development) plus potential future operational and environmental conditions (e.g., implementation of the RD-1644 Long-term instream flow requirements in the lower Yuba River) that probably would occur in the foreseeable future in the absence of the Proposed Project/Action or another action alternative. The NEPA No Action Alternative also is based on conditions without the proposed project, but uses a longer-term future timeframe that is not restricted by existing infrastructure or physical and regulatory environmental conditions. The differences between these modeling characterizations and assumptions for the CEQA No Project and the NEPA No Action alternatives, including the rationale for developing these two different scenarios for this EIR/EIS, are explained in Chapter 4[7].

Although implementation of the RD-1644 Long-term instream flow requirements would occur under both the CEQA No Project and the NEPA No Action alternatives, the resultant model outputs for both scenarios are different because of variations in the way near-term and long-term future operations are characterized for other parameters in the CEQA and NEPA assumptions. As discussed in Chapter 4, the principal difference between the CEQA No Project Alternative and the NEPA No Action Alternative is that the NEPA No Action Alternative includes several potential future water projects in the Sacramento and San Joaquin valleys (e.g., CVP/SWP Intertie, FRWP, SDIP and a long-term EWA Program or a program equivalent to the EWA), while the CEQA No Project Alternative does not. Because many of the other assumed conditions for these two scenarios are similar, the longer-term analysis of the NEPA No Action Alternative compared to the NEPA Affected Environment builds upon the nearer-term analysis of the CEQA No Project Alternative compared to the CEQA Existing Condition.

Because the same foundational modeling base (OCAP Study 3) was used to characterize near-term conditions (2001 level of development) both the CEQA No Project Alternative and the CEQA Existing Condition, it was possible to conduct a detailed analysis to quantitatively evaluate the hydrologic changes in the Yuba Region and the CVP/SWP system that would be expected to occur under these conditions. Building on this CEQA analysis, the analysis of the NEPA No Action Alternative compared to the NEPA Affected Environment consists of two components: (1) an analysis of near-term future without project conditions quantified through the CEQA No Project Alternative, relative to the CEQA Existing Condition; and (2) a qualitative analysis of longer-term future without project conditions (the NEPA No Action Alternative)[8].

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[7] For modeling purposes related to CEQA analytical requirements, OCAP Study 3 (2001 level of development) is used as the foundational study upon which the modeling scenarios for the CEQA No Project Alternative and the CEQA Existing Condition were developed. For modeling purposes related to NEPA analytical requirements, OCAP Study 5 (2020 level of development) is used as the foundational study upon which the modeling scenarios for the NEPA No Action Alternative was developed.

[8] The second analytical component cannot be evaluated quantitatively due to the differences in the underlying baseline assumptions for OCAP Study 3 and OCAP Study 5.

11.2.7.1 CEQA No Project Alternative Compared to the CEQA Existing Condition

Impact 11.2.7.1-1: Changes in New Bullards Bar Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the CEQA No Project Alternative is expected to alter New Bullards Bar reservoir water surface elevation, which could potentially impact shoreline vegetation and associated listed species. However, water surface elevation fluctuations under the CEQA No Project Alternative that would be within the range of water surface elevation fluctuations under the CEQA Existing Condition would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA No Project Alternative are within the range of those under the CEQA Existing Condition. Additionally, the shoreline of New Bullards Bar Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the CEQA Existing Condition would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the CEQA No Project Alternative resulting in end-of-month water surface elevations above those under the CEQA Existing Condition would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA No Project Alternative generally would be similar, ranging from 10 feet higher to 4 feet lower, relative to the CEQA Existing Condition. Average end-of-month reservoir water surface elevations by water year type also generally would be similar under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Specifically, average reservoir water surface elevation ranges from 25 feet higher during above normal years to 20 feet lower during critical years (Appendix F4, 2 vs. 1, pg 50).

End-of-month reservoir water surface elevations under the CEQA No Project Alternative would be equivalent to those under the CEQA Existing Condition approximately 36 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA No Project Alternative are within the range of those under the CEQA Existing Condition greater than 98 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA No Project Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the CEQA Existing Condition less than 2 percent of the time (1 time during each month). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the CEQA Existing Condition during any month of the growing season (Appendix F4, 2 vs. 1, pgs 56-62)

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA No Project Alternative are not expected to impact native shoreline vegetation because end-of-month water surface elevations generally are within the range of water surface water elevations under the CEQA Existing Condition. End-of-month water surface elevation decreases below the lowest water surface elevations under the CEQA Existing Condition would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the CEQA Existing Condition, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on New Bullards Bar Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.7.1-2: Changes in the New Bullards Bar Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on New Bullards Bar Reservoir fish species, including bald eagles, potentially could be affected by implementation of the CEQA No Project Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA No Project Alternative would not significantly impact the warmwater or coldwater fisheries. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in New Bullards Bar Reservoir associated with implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on terrestrial resources.

Impact 11.2.7.1-3: Changes in lower Yuba River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA No Project Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Yuba River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA No Project Alternative and the CEQA Existing Condition are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA No Project Alternative that would be within the range of stages under the CEQA Existing Condition would not increase the inundation or desiccation frequency of lower Yuba River riparian habitats.

Although flows and resultant stages under the CEQA No Project Alternative that would be within the range of those under the CEQA Existing Condition, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA Existing Condition, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA No Project Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA Existing Condition could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA No Project Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Yuba River.

As such, stage changes resulting from implementation of the CEQA No Project Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the CEQA Existing Condition would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA No Project Alternative of 1 foot or more that also would result in stages outside the range of stages under the CEQA Existing Condition could potentially impact riparian habitat along the lower Yuba River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA No Project Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages at Smartville under the CEQA No Project Alternative generally would be similar, ranging from 0.3 feet higher during May to 0.6 feet lower during August, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Specifically, average stages ranges from 0.7 feet higher during May of critical years to 0.9 feet lower during August of above normal years (Appendix F4, 2 vs. 1, pg. 149).

Monthly average stage decreases of 1 foot or more under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would occur at Smartville 2 times during March, 1 time during April, 15 times during July and August, and 2 times during September, while a stage increase of 1 foot or more occurs 1 times during March, 2 times during April, 11 times during May, and 3 times during June. Stages occurring outside the range of stages under the CEQA Existing Condition would occur 1 time during May through September. However, no stage differences of 1 foot or more would result in a stage outside the range of stages under the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs. 167-173).

Based on analysis of simulated flows and resultant stages at Smartville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the CEQA No Project Alternative generally would be similar to those under the CEQA Existing Condition during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the CEQA No Project Alternative and the CEQA Existing Condition, indicating that riparian habitat would not be exposed to overly stable flows under the CEQA No Project Alternative. During dry years, however, flows would have a slightly more stable flow regime under the CEQA No Project Alternative, relative to the CEQA Existing Condition.

Analysis of model results indicates that long-term average end-of-month stages at Marysville under the CEQA No Project Alternative generally would be similar, ranging from 0.2 feet higher during May to 0.6 feet lower during July and August, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Specifically, average stages ranges from 0.8 feet higher during May of critical years to 1.1 feet lower during July and August of above normal years (Appendix F4, 2 vs. 1, pg 321).

Monthly average stage decreases of 1 foot or more under the CEQA No Project Alternative, relative to the CEQA Existing Condition would occur at Marysville 2 times during March, 23 times during July, 19 times during August, and 2 times during September, while stage increases of 1 foot or more occur 1 times during April, 11 times during May, and 3 times during June. Stages occurring outside the range of stages under the CEQA Existing Condition would not occur (Appendix F4, 2 vs. 1, pgs. 339-345).

Based on analysis of simulated flows and resultant stages at Marysville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the CEQA No Project Alternative generally would be similar to those under the CEQA Existing Condition during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the CEQA No Project Alternative and the CEQA Existing Condition, indicating that riparian habitat would not be exposed to overly stable flows under the CEQA No Project Alternative. During dry years, however, flows would have a slightly more stable flow regime under the CEQA No Project Alternative, relative to the CEQA Existing Condition.

Model simulations of lower Yuba River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA No Project Alternative outside the range of stages under the CEQA Existing Condition at Smartville or Marysville. Additionally, the pattern of flows and stages among months under the CEQA No Project Alternative would be similar to those under the CEQA Existing Condition. Therefore, implementation of the CEQA No Project Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would be expected to have a less than significant impact on riparian habitat adjacent to the Yuba River that may be used by terrestrial resources.

Impact 11.2.7.1-4: Changes in Oroville Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Because releases from Oroville Reservoir are utilized to meet water quality and quantity requirements in the Delta, in response to water transfers from and flow requirements in the Yuba River, implementation of the CEQA No Project Alternative could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the CEQA No Project Alternative that would be within the range of water surface elevation fluctuations under the CEQA Existing Condition would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA No Project Alternative are within the range of those under the

CEQA Existing Condition. Additionally, the shoreline of Oroville Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the CEQA Existing Condition would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the CEQA No Project Alternative resulting in end-of-month water surface elevations above those under the CEQA Existing Condition would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the CEQA No Project Alternative generally would be similar, ranging from 1 foot higher to equivalent, relative to the CEQA Existing Condition. Average end-of-month reservoir water surface elevations by water year type also generally would be similar under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Specifically, average reservoir water surface elevation ranges from 1 foot higher during dry and critical years to 1 foot lower during wet, above normal, and below normal years (Appendix F4, 2 vs. 1, pg 455).

End-of-month reservoir water surface elevations under the CEQA No Project Alternative would be equivalent to those under the CEQA Existing Condition approximately 81 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA No Project Alternative are within the range of those under the CEQA Existing Condition 100 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA No Project Alternative would not be expected to decrease below the lowest or increase above the highest end-of-month water surface elevations under the CEQA Existing Condition during any month of the growing season (Appendix F4, 2 vs. 1, pgs 461-467).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA No Project Alternative are not expected to impact shoreline vegetation because end-of-month water surface elevations generally would be equivalent to those under the CEQA Existing Condition. Additionally, when end-of-month reservoir water surface elevations under the CEQA No Project Alternative and Existing Condition are not equivalent, they would not fluctuate outside the range of water surface elevations under the CEQA Existing Condition, which would not expose additional shoreline or inundate existing shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on New Bullards Bar Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.7.1-5: Changes in the Oroville Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on Oroville Reservoir fish species, including bald eagles, potentially could be affected by implementation of the CEQA No Project Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA No Project Alternative would not significantly impact the warmwater or coldwater fisheries in Oroville Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in Oroville Reservoir associated with implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on terrestrial resources.

Impact 11.2.7.1-6: Changes in lower Feather River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA No Project Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Feather River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA No Project Alternative and the CEQA Existing Condition are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA No Project Alternative that would be within the range of stages under the CEQA Existing Condition would not increase the inundation or desiccation frequency of lower Feather River riparian habitats.

Although flows and resultant stages under the CEQA No Project Alternative that would be within the range of those under the CEQA Existing Condition, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA Existing Condition, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA No Project Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA Existing Condition could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA No Project Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Feather River.

As such, stage changes resulting from implementation of the CEQA No Project Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the CEQA Existing Condition would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA No Project Alternative of 1 foot or more that also would result in stages outside the range of stages under the CEQA Existing Condition could potentially impact riparian habitat along the lower Feather River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA No Project Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Average monthly flows, and resultant stages, in the Feather River below the Fish Barrier Dam would be equivalent under the CEQA No Project Alternative and the CEQA Existing Condition for all months during the riparian habitat analytical period (Appendix F4, 2 vs. 1, pgs. 542-553).

Analysis of model results indicates that long-term average end-of-month stages below the Thermalito Afterbay under the CEQA No Project Alternative generally would be similar, ranging from 0.1 feet higher during June to 0.1 feet lower during March, April, and May, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Specifically, average stages ranges from 0.1 feet higher during August and September of below normal years and June of dry and critical years to 0.2 feet lower during May of critical years (Appendix F4, 2 vs. 1, pg 652).

Monthly average stage decreases of 1 foot or more under the CEQA No Project Alternative, relative to the CEQA Existing Condition would occur below the Thermalito Afterbay Outlet 1 time during May, while stage increases of 1 foot or more would not occur. Stages occurring outside the range of stages under the CEQA Existing Condition would occur 1 time during August (Appendix F4, 2 vs. 1, pgs 670-676).

Based on analysis of simulated flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the CEQA No Project Alternative and the CEQA Existing Condition. Specifically, average flows at each location generally increase and decrease during similar time periods during the growing season, which indicates that riparian habitat would not be exposed to overly stable flows under the CEQA No Project Alternative. As such, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the CEQA Existing Condition also would be expected to increase and decrease during those same time periods under the CEQA No Project Alternative. Because riparian species are adapted to the pattern of floodplain inundation and bench exposure to which they are exposed, and rely on those patterns for successful reproduction, the long-term average flow pattern and flow pattern by water year type under the CEQA No Project Alternative would not substantially affect riparian species reproduction in the Feather River.

Model simulations of lower Feather River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA No Project Alternative outside the range of stages under the CEQA Existing Condition below the Thermalito Afterbay. Additionally, the pattern of flows and stages among months under the CEQA No Project Alternative would be similar to those under the CEQA Existing Condition. Therefore, implementation of the CEQA No Project Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would be expected to have a less than significant impact on riparian habitat adjacent to the lower Feather River that may be used by terrestrial resources.

Impact 11.2.7.1-7: Changes in lower Sacramento River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the CEQA No Project Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Sacramento River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the CEQA No Project Alternative and the CEQA Existing Condition are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the CEQA No Project Alternative that would be within the range of stages under the CEQA Existing Condition would not increase the inundation or desiccation frequency of lower Sacramento River riparian habitats.

Although flows and resultant stages under the CEQA No Project Alternative that would be within the range of those under the CEQA Existing Condition, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the CEQA Existing Condition, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the CEQA No Project Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the CEQA Existing Condition could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the CEQA No Project Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Sacramento River.

As such, stage changes resulting from implementation of the CEQA No Project Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the CEQA Existing Condition would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the CEQA No Project Alternative of 1 foot or more that also would result in stages outside the range of stages under the CEQA Existing Condition could potentially impact riparian habitat along the lower Sacramento River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the CEQA No Project Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages below the Feather River confluence under the CEQA No Project Alternative generally would be similar, ranging from 0.1 feet higher during June to 0.2 feet lower during July and August, relative to the CEQA Existing Condition. Average end-of-month stages by water year type also generally would be similar under the CEQA No Project Alternative, relative to the CEQA Existing Condition. Specifically, average stages range from 0.3 feet higher during June of critical years to 0.5 feet lower during July and August of above normal years (Appendix F4, 2 vs.1, pg. 931).

Monthly average stage decreases of 1 foot or more under the CEQA No Project Alternative, relative to the CEQA Existing Condition, would occur below the Feather River confluence 1 time during March, while stage increases of 1 foot or more would not occur. Stages occurring outside the range of stages under the CEQA Existing Condition would occur 1 time during March and 2 times during July. However, no stage differences of 1 foot or more would result in a stage outside the range of stages under the CEQA Existing Condition (Appendix F4, 2 vs. 1, pgs 949-955).

Based on analysis of simulated flows in the Sacramento River below the Feather River confluence and at Freeport, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the CEQA No Project Alternative and the CEQA Existing Condition. Specifically, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the CEQA Existing Condition also would be expected to increase and decrease during those same time periods under the CEQA No Project Alternative. Therefore, the long-term average flow pattern and flow pattern by water year type under the CEQA No Project Alternative would not substantially affect riparian species reproduction in the Sacramento River.

Model simulations of lower Sacramento River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the CEQA No Project Alternative outside the range of stages under the CEQA Existing Condition below the Feather River confluence. Additionally, the pattern of flows and stages among months under the CEQA No Project Alternative would be similar to those under the CEQA Existing Condition. Therefore, implementation of the CEQA No Project Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would be expected to have a less than significant impact on riparian habitat adjacent to the lower Sacramento River that may be used by terrestrial resources.

Impact 11.2.7.1-8: Changes in San Luis Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the CEQA No Project Alternative could alter San Luis Reservoir water surface elevation, which could potentially impact shoreline vegetation and associated listed species. However, water surface elevation fluctuations under the CEQA No Project Alternative that would be within the range of water surface elevation fluctuations under the CEQA Existing Condition would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the CEQA No Project Alternative are within the range of those under the CEQA Existing Condition. Unlike most foothill reservoirs, San Luis Reservoir contains gently sloping shoreline upon which riparian vegetation can colonize. Reservoir operations maintain riparian vegetation along the shoreline of San Luis Reservoir perpetually in an early successional stage due to frequent water surface elevation fluctuations. However, water surface elevation reductions resulting in end-of-month water surface elevations below those under the CEQA Existing Condition would not substantially affect shoreline vegetation because those water surface elevation reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Additionally, reservoir water surface elevation increases under the CEQA No Project Alternative resulting in end-of-month water surface elevations above those under the CEQA Existing Condition would be expected to inundate shoreline vegetation. However, under those conditions reservoir operations would continue to maintain riparian habitat in an early successional stage.

Analysis of model results indicates that long-term average end-of-month San Luis Reservoir water surface elevations under the CEQA No Project Alternative and Existing Condition would be equivalent. Average end-of-month reservoir water surface elevations by water year type also would be equivalent (Appendix F4, 2 vs. 1, pg 1413).

End-of-month reservoir water surface elevations under the CEQA No Project Alternative would be equivalent to those under the CEQA Existing Condition approximately 99 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the CEQA No Project Alternative are within the range of those under the CEQA Existing Condition 100 percent of the time. As such, end-of-month reservoir water surface elevation under the CEQA No Project Alternative would not be expected to decrease below the lowest or increase above the highest end-of-month water surface elevations under the CEQA Existing Condition during any month of the growing season (Appendix F4, 2 vs. 1, pgs 1419-1425).

The reservoir water surface elevation fluctuations that could be expected to occur under the CEQA No Project Alternative are not expected to substantially impact shoreline vegetation because end-of-month water surface elevations generally would be equivalent to those under the CEQA Existing Condition. Additionally, when end-of-month reservoir water surface elevations under the CEQA No Project Alternative and Existing Condition are not equivalent, they would not fluctuate outside the range of water surface elevations under the CEQA Existing Condition, which would not expose additional shoreline or inundate existing shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on San Luis Reservoir shoreline riparian vegetation that may be used by terrestrial resources.

Impact 11.2.7.1-9: Changes in the San Luis Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality.

Piscivorous birds that forage on San Luis Reservoir fishes potentially could be affected by implementation of the CEQA No Project Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the CEQA No Project Alternative would not significantly impact warmwater or coldwater fisheries in San Luis Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in San Luis Reservoir associated with implementation of the CEQA No Project Alternative, relative to the CEQA Existing Condition, would have a less than significant impact on terrestrial resources.

11.2.7.2 NEPA No Action Alternative Compared to the NEPA Affected Environment

In the Yuba Region, the primary differences between the NEPA No Action Alternative and the NEPA Affected Environment would be the changes in lower Yuba River flows associated with the implementation of the RD-1644 Long-term instream flow requirements, to replace the RD-1644 Interim instream flow requirements, and the increased local surface water demands for the Wheatland Water District. These also are the primary differences that would occur in the Yuba Region between the CEQA No Project Alternative and the CEQA Existing Condition. The potential effects to terrestrial resources that were evaluated in the quantitative analyses that is presented in Section 11.2.7.1 above for the CEQA No Project Alternative relative to the CEQA Existing Condition (see also Appendix F4, 2 vs. 1) therefore also are used for comparison of the NEPA No Action Alternative relative to the NEPA Affected Environment, and are not repeated here.

As discussed above, the analysis of the NEPA No Action Alternative includes several additional proposed projects in the project study area that are not included in the CEQA analysis. However, these other proposed projects would not significantly affect hydrologic conditions or terrestrial resources in the Yuba Region and, thus, are only discussed in the context of CVP/SWP operations upstream of and within the Delta.

Under the NEPA No Action Alternative, future levels of demand for water in California would be addressed through the implementation of numerous projects, including water storage and conveyance projects (e.g., SDIP[9]), water transfers and acquisition programs (e.g., a long-term EWA Program or a program equivalent to the EWA), and other projects related to CVP/SWP system operations (e.g., CVP/SWP Intertie and FRWP).

Future changes in operations of water conveyance projects, water transfers and acquisition programs, and other projects related to CVP/SWP system operations under the NEPA No Action Alternative have the potential to result in changes in reservoir storage volumes, river flows and water temperatures, and Delta conditions, relative to the NEPA Affected Environment. The general changes that may occur and that could affect special-status and other terrestrial species include:

- Increased surface water diversion and storage;
- Improved water supply reliability and water management flexibility; and
- Requirements for compatibility with objectives and continued improvement of Delta water quality.

Compared to the NEPA Affected Environment, projects related to CVP/SWP system operations under the NEPA No Action Alternative have the potential to result in changes in reservoir storage volumes, river flows and water temperatures, and Delta conditions. CVP/SWP system

[9] The SDIP includes a maximum pumping rate of 8,500 cfs at the Banks Pumping Plant.

operational changes could affect north of Delta hydrology by altering flow and water temperature patterns (timing, magnitude and frequency), as well as Delta inflows, outflows, X2 location and exports. The potential exists for reduced stream flows, Delta outflow, changed seasonal flow, water temperature variability, and changes in Delta salinity conditions that could result in effects to aquatic habitats and riparian areas used by wildlife. Potential factors that may contribute to effects under the NEPA No Action Alternative may include reduced habitat abundance, impaired species movement, and geographic relocation and/or restriction to less suitable habitats.

Several water projects (e.g., a long-term EWA Program or a program equivalent to the EWA) could purchase water through groundwater substitution programs. Under the NEPA No Action Alternative, groundwater substitution programs would involve groundwater actions based on individual environmental documents required for the use of CVP and SWP facilities, and would take place in a manner that is similar to what occurs under the NEPA Affected Environment. The oversight of water transfers by Reclamation and DWR would continue to ensure that the effects on wetlands and other vegetation communities because of groundwater substitution actions would be avoided or minimized.

As with conditions under the NEPA Affected Environment, actions to protect terrestrial resources in the CVP/SWP system that are mandated by existing regulatory requirements would continue in the future under the NEPA No Action Alternative. Under this alternative, Reclamation and DWR would continue to comply with the 2004/2005 OCAP BOs or successor documents developed by USFWS and NMFS under the ESA to protect listed species in the CVP/SWP system.

For the reasons discussed above, it is anticipated that the water conveyance projects, water transfer and acquisition programs, and other projects related to CVP/SWP operations under the NEPA No Action Alternative potentially could affect terrestrial resources in the CVP/SWP system. Potential impacts on terrestrial resources could be either positive or negative, depending on the overall timing and operation of other projects that would occur under the NEPA No Action Alternative.

11.2.8 Environmental Impacts/Environmental Consequences of the NEPA Yuba Accord Alternative Compared to the NEPA No Action Alternative

Impact 11.2.8-1: Changes in New Bullards Bar Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the NEPA Yuba Accord Alternative is expected to alter New Bullards Bar reservoir water surface elevation, which could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the NEPA Yuba Accord Alternative that would be within the range of water surface elevation fluctuations under the NEPA No Action Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the NEPA Yuba Accord Alternative are within the range of those under the NEPA No Action Alternative. Additionally, the shoreline of New Bullards Bar Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the NEPA No Action Alternative would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the NEPA Yuba Accord Alternative resulting in end-of-month water surface elevations above those under the NEPA No Action Alternative would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the NEPA Yuba Accord Alternative generally are lower, but range from equivalent to 13 feet lower, relative to the NEPA No Action Alternative. Average end-of-month reservoir water surface elevations by water year type also generally are lower under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. However, average reservoir water surface elevation ranges from 5 feet higher during June of dry years to 17 feet lower during September of above normal years (Appendix F4, 6 vs. 5, pg 50).

End-of-month reservoir water surface elevations under the NEPA Yuba Accord Alternative would be equivalent to those under the NEPA No Action Alternative approximately 32 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the NEPA Yuba Accord Alternative are within the range of those under the NEPA No Action Alternative approximately 99 percent of the time. As such, end-of-month reservoir water surface elevation under the NEPA Yuba Accord Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the NEPA No Action Alternative approximately 1 percent of the time (1 time during each month from March through July). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the NEPA No Action Alternative during any month of the growing season (Appendix F4, 6 vs. 5, pgs 56-62).

The reservoir water surface elevation fluctuations that could be expected to occur under the NEPA Yuba Accord Alternative are not expected to substantially impact shoreline vegetation because end-of-month water surface elevations generally are within the range of water surface water elevations under the NEPA No Action Alternative. End-of-month water surface elevation decreases below the lowest water surface elevations under the NEPA No Action Alternative would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the NEPA No Action Alternative, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on New Bullards Bar Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.8-2: Changes in the New Bullards Bar Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on New Bullards Bar Reservoir fish species, including bald eagles, potentially be could affected by implementation of the NEPA Yuba Accord Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the NEPA Yuba Accord Alternative would not significantly impact the warmwater or coldwater fisheries. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in New Bullards Bar Reservoir associated with implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on terrestrial resources.

Impact 11.2.8-3: Changes in lower Yuba River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the NEPA Yuba Accord Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Yuba River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the NEPA Yuba Accord Alternative and the NEPA No Action Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that would occur under the NEPA Yuba Accord Alternative that would be within the range of stages under the NEPA No Action Alternative would not increase the inundation or desiccation frequency of lower Yuba River riparian habitats.

Although flows and resultant stages under the NEPA Yuba Accord Alternative that would be within the range of those under the NEPA No Action Alternative, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the NEPA No Action Alternative, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the NEPA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the NEPA No Action Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the NEPA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Yuba River.

As such, stage changes resulting from implementation of the NEPA Yuba Accord Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that would occur within the range of stages that are expected to occur under the NEPA No Action Alternative would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the NEPA Yuba Accord Alternative of 1 foot or more that also would result in stages outside the range of stages under the NEPA No Action Alternative could potentially impact riparian habitat along the lower Yuba River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the NEPA Yuba Accord Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages at Smartville under the NEPA Yuba Accord Alternative generally would be similar, ranging from 0.5 feet higher during August to 0.2 feet lower during May, relative to the NEPA No Action Alternative. Average end-of-month stages by water year type also generally would be similar under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. Specifically, average stages range from 0.7 feet higher during August of below normal years to 0.6 feet lower during January and May of dry years (Appendix F4, 6 vs. 5, pg 149).

Monthly average stage decreases of 1 foot or more under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would occur at Smartville 2 times during March, April, and May, while a stage increase of 1 foot or more would occur 1 time during April, July, and August, and 2 times during September. Stages occurring outside the range of stages under the NEPA No Action Alternative would occur 1 time during March through July and 2 times during August and September. However, no stage differences of 1 foot or more would result in a stage outside the range of stages under the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs 167-173).

Based on analysis of simulated flows and resultant stages at Smartville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, below normal, and critical years, indicate that flow changes among months under the NEPA Yuba Accord Alternative generally would be similar to those under the NEPA No Action Alternative during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative, indicating that riparian habitat would not be exposed to overly stable flows under the NEPA Yuba Accord Alternative. During dry years, however, flows would have a slightly more stable flow regime under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative.

Analysis of model results indicates that long-term average end-of-month stages at Marysville under the NEPA Yuba Accord Alternative generally would be similar, ranging from 0.6 feet higher during August to 0.2 feet lower during May, relative to the NEPA No Action Alternative. Average end-of-month stages by water year type also generally would be similar under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. Specifically, average stages range from 0.7 feet higher during August of wet and below normal years to 0.5 feet lower during May of dry years (Appendix F4, 6 vs. 5, pg 321).

Monthly average stage decreases of 1 foot or more under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would occur at Marysville 1 time during March, while stage increases of 1 foot or more would occur 2 times during July, and 3 times during August. Stages occurring outside the range of stages under the NEPA No Action Alternative would occur 1 time during March, 2 times during May, 5 times during June, 2 times during July and August, and 1 time during September. However, no stage differences of 1 foot or more would result in a stage outside the range of stages under the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs 339-345).

Based on analysis of simulated flows and resultant stages at Marysville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, and below normal, years, indicate that flow changes among months under the NEPA Yuba Accord Alternative generally would be similar to those under the NEPA No Action Alternative during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative, indicating that riparian habitat would not be exposed to overly stable flows under the NEPA Yuba Accord Alternative. During dry years, however, flows would have a slightly more stable flow regime under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. During critical years flows would not increase during May under the NEPA Yuba Accord Alternative as they do under the NEPA No Action Alternative.

Model simulations of lower Yuba River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the NEPA Yuba Accord Alternative outside the range of stages under the NEPA No Action Alternative at Smartville or Marysville. Additionally, the pattern of flows and stages among months under the NEPA Yuba Accord Alternative would be similar to those under the NEPA No Action Alternative. Therefore, implementation of the NEPA Yuba Accord Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would be expected to have a less than significant impact on riparian habitat adjacent to the Yuba River that may be used by terrestrial resources.

Impact 11.2.8-4: Changes in Oroville Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Because releases from Oroville Reservoir are utilized to meet water quality and quantity requirements in the Delta, in response to water transfers from and flow requirements in the Yuba River, implementation of the NEPA Yuba Accord Alternative could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the NEPA Yuba Accord Alternative that would be within the range of water surface elevation fluctuations under the NEPA No Action Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the NEPA Yuba Accord Alternative are within the range of those under the NEPA No Action Alternative. Additionally, the shoreline of Oroville Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the NEPA No Action Alternative would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the NEPA Yuba Accord Alternative resulting in end-of-month water surface elevations above those under the NEPA No Action Alternative would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations would be equivalent under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative. Average end-of-month reservoir water surface elevations by water year type also generally would be equivalent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. Specifically, average reservoir water surface elevations range from 2 feet higher during critical years to 1 foot lower during above normal, below normal, dry, and critical years (Appendix F4, 6 vs. 5, pg 455).

End-of-month Oroville Reservoir water surface elevations under the NEPA Yuba Accord Alternative would be equivalent to those under the NEPA No Action Alternative approximately 69 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the NEPA Yuba Accord Alternative are within the range of those under the NEPA No Action Alternative approximately 99 percent of the time. As such, end-of-month reservoir water surface elevation under the NEPA Yuba Accord Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the NEPA No Action Alternative approximately 1 percent of the time (1 time during each month from March through May and September). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the NEPA No Action Alternative during any month of the growing season (Appendix F4, 6 vs. 5, pgs 461-467).

The reservoir water surface elevation fluctuations that could be expected to occur under the NEPA Yuba Accord Alternative are not expected to substantially impact shoreline vegetation because end-of-month water surface elevations generally are within the range of water surface water elevations under the NEPA No Action Alternative. End-of-month water surface elevation decreases below the lowest water surface elevations under the NEPA No Action Alternative would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the NEPA No Action Alternative, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on Oroville Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.8-5: Changes in the Oroville Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on Oroville Reservoir fish species, including bald eagles, potentially could be affected by implementation of the NEPA Yuba Accord Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the NEPA Yuba Accord Alternative would not significantly impact the warmwater or coldwater fisheries in Oroville Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in Oroville Reservoir associated with implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on terrestrial resources.

Impact 11.2.8-6: Changes in lower Feather River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the NEPA Yuba Accord Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Feather River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the NEPA Yuba Accord Alternative and the NEPA No Action Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that occur under the NEPA Yuba Accord Alternative that would be within the range of stages under the NEPA No Action Alternative would not increase the inundation or desiccation frequency of lower Feather River riparian habitats.

Although flows and resultant stages under the NEPA Yuba Accord Alternative that would be within the range of those under the NEPA No Action Alternative, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the NEPA No Action Alternative, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the NEPA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the NEPA No Action Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the NEPA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Feather River.

As such, stage changes resulting from implementation of the NEPA Yuba Accord Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that occur within the range of stages that are expected to occur under the NEPA No Action Alternative would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the NEPA Yuba Accord Alternative of 1 foot or more that also would result in stages outside the range of stages under the NEPA No Action Alternative could potentially impact riparian habitat along the lower Feather River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the NEPA Yuba Accord Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Average monthly flows, and resultant stages, in the Feather River below the Fish Barrier Dam would be equivalent under the NEPA Yuba Accord Alternative and the NEPA No Action

Alternative for all months during the riparian habitat analytical period (Appendix F4, 6 vs. 5, pgs 547-553).

Analysis of model results indicates that long-term average end-of-month stages below the Thermalito Afterbay under the NEPA Yuba Accord Alternative generally would be similar, ranging from 0.1 feet higher during May to 0.1 feet lower during April, relative to the NEPA No Action Alternative. Average end-of-month stages by water year type also generally would be similar under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. Specifically, average stages range from 0.1 feet higher during wet, above normal, and critical years to 0.2 feet lower during critical years (Appendix F4, 6 vs. 5, pg 652).

Monthly average stage decreases of 1 foot or more under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative would not occur below the Thermalito Afterbay Outlet, while stage increases of 1 foot or more occur 1 time during May. Stages under the NEPA Yuba Accord Alternative that result in stages outside the range of stages under the NEPA No Action Alternative would not occur (Appendix F4, 6 vs. 5, pgs 670-676).

Based on analysis of simulated flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative. Specifically, average flows at each location generally increase and decrease during similar time periods during the growing season, which indicates that riparian habitat would not be exposed to overly stable flows under the NEPA Yuba Accord Alternative. As such, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the NEPA No Action Alternative also would be expected to increase and decrease during those same time periods under the NEPA Yuba Accord Alternative. Because riparian species are adapted to the pattern of floodplain inundation and bench exposure to which they are exposed, and rely on those patterns for successful reproduction, the long-term average flow pattern and flow pattern by water year type under the NEPA Yuba Accord Alternative would not substantially affect riparian species reproduction in the Feather River.

Model simulations of lower Feather River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the NEPA Yuba Accord Alternative outside the range of stages under the NEPA No Action Alternative below the Thermalito Afterbay Outlet. Additionally, the pattern of flows and stages among months under the NEPA Yuba Accord Alternative would be similar to those under the NEPA No Action Alternative. Therefore, implementation of the NEPA Yuba Accord Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would be expected to have a less than significant impact on riparian habitat adjacent to the lower Feather River that may be used by terrestrial resources.

Impact 11.2.8-7: Changes in lower Sacramento River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the NEPA Yuba Accord Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Sacramento River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the NEPA Yuba Accord Alternative and the NEPA No Action Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that occur under the NEPA Yuba Accord Alternative that would be within the range of stages under the NEPA No Action Alternative would not increase the inundation or desiccation frequency of lower Sacramento River riparian habitats.

Although flows and resultant stages under the NEPA Yuba Accord Alternative that would be within the range of those under the NEPA No Action Alternative, or are less than 1 foot in magnitude would not cause desiccation or inundation of additional riparian habitat, relative to the NEPA No Action Alternative, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the NEPA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the NEPA No Action Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the NEPA Yuba Accord Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Sacramento River.

As such, stage changes resulting from implementation of the NEPA Yuba Accord Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that occur within the range of stages that are expected to occur under the NEPA No Action Alternative would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the NEPA Yuba Accord Alternative of 1 foot or more that also would result in stages outside the range of stages under the NEPA No Action Alternative could potentially impact riparian habitat along the lower Sacramento River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the NEPA Yuba Accord Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages below the Feather River confluence under the NEPA Yuba Accord Alternative generally would be similar, ranging from 0.3 feet higher during July and August to 0.1 feet lower during May, and June, relative to the NEPA No Action Alternative. Average end-of-month stages by water year type also generally would be similar under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. Specifically, average stages range from 0.3 feet higher during wet, above normal, and below normal years, to 0.3 feet lower during critical years (Appendix F4, 6 vs. 5, pg 931).

Monthly average stage decreases and increases of 1 foot or more under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would not occur in the Sacramento River below the Feather River confluence. Stages occurring outside the range of stages under the NEPA No Action Alternative would occur 1 time during May, 2 times during June, and 1 time during July. However, no stage differences of 1 foot or more would result in a stage outside the range of stages under the NEPA No Action Alternative (Appendix F4, 6 vs. 5, pgs 949-955).

Based on analysis of simulated flows in the Sacramento River below Feather River confluence and at Freeport, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the NEPA Yuba Accord Alternative and the NEPA No Action Alternative. Specifically, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the NEPA No Action Alternative also would be expected to increase and decrease during those same time periods under the NEPA Yuba Accord Alternative. Therefore, the long-term average flow pattern and flow pattern by water year type under the NEPA Yuba Accord Alternative would not substantially affect riparian species reproduction in the Sacramento River.

Model simulations of lower Sacramento River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the NEPA Yuba Accord Alternative outside the range of stages under the NEPA No Action Alternative below the Feather River confluence. Additionally, the pattern of flows and stages among months under the NEPA Yuba Accord Alternative would be similar to those under the NEPA No Action Alternative. Therefore, implementation of the NEPA Yuba Accord Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would be expected to have a less than significant impact on riparian habitat adjacent to the lower Sacramento River that may be used by terrestrial resources.

Impact 11.2.8-8: Changes in San Luis Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the NEPA Yuba Accord Alternative could alter San Luis Reservoir water surface elevation, which could potentially impact shoreline vegetation and associated listed species. However, water surface elevation fluctuations under the NEPA Yuba Accord Alternative that would be within the range of water surface elevation fluctuations under the NEPA No Action Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the NEPA Yuba Accord Alternative are within the range of those under the NEPA No Action Alternative. Unlike most foothill reservoirs, San Luis Reservoir contains gently sloping shoreline upon which riparian vegetation can colonize. Reservoir operations maintain riparian vegetation along the shoreline of San Luis Reservoir perpetually in an early successional stage due to frequent water surface elevation fluctuations. However, water surface elevation reductions resulting in end-of-month water surface elevations below those under the NEPA No Action Alternative would not substantially affect shoreline vegetation because those water surface elevation reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Additionally, reservoir water surface elevation increases under the NEPA Yuba Accord Alternative resulting in end-of-month water surface elevations above those under the NEPA No Action Alternative would be expected to inundate shoreline vegetation. However, under those conditions reservoir operations would continue to maintain riparian habitat in an early successional stage.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the NEPA Yuba Accord Alternative generally would be equivalent, but range from equivalent to 1 foot lower, relative to the NEPA No Action Alternative. Average end-of-month reservoir water surface elevations by water year type also generally would be equivalent under the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative. Specifically, average reservoir water surface elevations would be equivalent during all months of the riparian habitat growing season during wet, above normal, and below normal years, and range from equivalent to 1 foot lower during dry and critical years (Appendix F4, 6 vs. 5, pg 1413).

End-of-month San Luis Reservoir water surface elevations under the NEPA Yuba Accord Alternative would be equivalent to those under the NEPA No Action Alternative approximately 91 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the NEPA Yuba Accord Alternative are within the range of those under the NEPA No Action Alternative greater than 99 percent of the time. As such, end-of-month reservoir water surface elevation under the NEPA Yuba Accord Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the NEPA No Action Alternative less than 1 percent of the time (1 time during September). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the NEPA No Action Alternative during any month of the growing season (Appendix F4, 6 vs. 5, pgs 1419-1425).

The reservoir water surface elevation fluctuations that could be expected to occur under the NEPA Yuba Accord Alternative are not expected to substantially impact shoreline vegetation because they generally are within the range of Reservoir water surface elevations under the NEPA No Action Alternative. End-of-month water surface elevation decreases below the lowest water surface elevations under the NEPA No Action Alternative would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the NEPA No Action Alternative, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on San Luis Reservoir shoreline riparian vegetation that may be used by terrestrial resources.

Impact 11.2.8-9: Changes in the San Luis Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on San Luis Reservoir fishes potentially could be affected by implementation of the NEPA Yuba Accord Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the NEPA Yuba Accord Alternative would not significantly impact warmwater or coldwater fisheries in San Luis Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in San Luis Reservoir associated with implementation of the NEPA Yuba Accord Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on terrestrial resources.

11.2.9 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE NEPA MODIFIED FLOW ALTERNATIVE COMPARED TO THE NEPA NO ACTION ALTERNATIVE

Impact 11.2.9-1: Changes in New Bullards Bar Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Implementation of the NEPA Modified Flow Alternative is expected to alter New Bullards Bar reservoir water surface elevation, which could potentially impact shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the NEPA Modified Flow Alternative that would be within the range of water surface elevation fluctuations under the NEPA No Action Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the NEPA Modified Flow Alternative are within the range of those under the NEPA No Action Alternative. Additionally, the shoreline of New Bullards Bar Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the NEPA No Action Alternative would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the NEPA Modified Flow Alternative resulting in end-of-month water surface elevations above those under the NEPA No Action Alternative would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the NEPA Modified Flow Alternative generally are lower, but range from 4 feet higher to 7 feet lower, relative to the NEPA No Action Alternative. Average end-of-month reservoir water surface elevations by water year type also generally are lower except during critical years, which generally are higher under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Specifically, average reservoir water surface elevation ranges from 22 feet higher during critical years to 17 feet lower during above normal years (Appendix F4, 7 vs. 5, pg 50).

End-of-month reservoir water surface elevations under the NEPA Modified Flow Alternative would be equivalent to those under the NEPA No Action Alternative approximately 42 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the NEPA Modified Flow Alternative are within the range of those under the NEPA No Action Alternative 100 percent of the time. As such, end-of-month reservoir water surface elevation under the NEPA Modified Flow Alternative would not be expected to decrease below the lowest or increase above the highest end-of-month water surface elevations under the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs 56-62).

The reservoir water surface elevation fluctuations that could be expected to occur under the NEPA Modified Flow Alternative are not expected to impact shoreline vegetation because end-of-month water surface elevations generally would be similar to those under the NEPA No Action Alternative. Additionally, end-of-month reservoir water surface elevations under the NEPA Modified Flow Alternative and No Action Alternative would not fluctuate outside the range of water surface elevations under the NEPA No Action Alternative, which would not expose additional shoreline or inundate existing shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on New Bullards Bar Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.9-2: Changes in the New Bullards Bar Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on New Bullards Bar Reservoir fish species, including bald eagles, potentially could be affected by implementation of the NEPA Modified Flow Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the NEPA Modified Flow Alternative would not significantly impact the warmwater or coldwater fisheries in New Bullards Bar Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in New Bullards Bar Reservoir associated with implementation of the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on terrestrial resources.

Impact 11.2.9-3: Changes in lower Yuba River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the NEPA Modified Flow Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Yuba River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the NEPA Modified Flow Alternative and the NEPA No Action Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that occur under the NEPA Modified Flow Alternative that would be within the range of stages under the NEPA No Action Alternative would not increase the inundation or desiccation frequency of lower Yuba River riparian habitats.

Although flows and resultant stages under the NEPA Modified Flow Alternative that would be within the range of those under the NEPA No Action Alternative, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the NEPA No Action Alternative, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the NEPA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the NEPA No Action Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the NEPA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Yuba River.

As such, stage changes resulting from implementation of the NEPA Modified Flow Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that occur within the range of stages that are expected to occur under the NEPA No Action Alternative would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the NEPA Modified Flow Alternative of 1 foot or more that also would result in stages outside the range of stages under the NEPA No Action Alternative could potentially impact riparian habitat along the lower Yuba River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the NEPA Modified Flow Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages at Smartville under the NEPA Modified Flow Alternative generally would be similar, ranging from 0.4 feet higher during August to 0.3 feet lower during May, relative to the NEPA No Action Alternative. Average end-of-month stages by water year type also generally would be similar under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Specifically, average stages ranges from 0.6 feet higher during August of wet years to 0.7 feet lower during May of critical years (Appendix F4, 7 vs. 5, pg 149).

Monthly average stage decreases of 1 foot or more under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would occur at Smartville 1 time during March, 2 times during April, 11 times during May, and 2 times during June, while a stage increase of 1 foot or more occurs 1 time during March and April, 4 times during July, 7 times during August, and 4 times during September. Stages occurring outside the range of stages under the NEPA No Action Alternative would occur 1 time during April through July, 2 times during August, and 3 times during September. In addition, stage differences of 1 foot or more would result in a stage outside the range of stages under the NEPA No Action Alternative 3 times (Appendix F4, 7 vs. 5, pgs 167-173).

Based on analysis of simulated flows and resultant stages at Smartville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, and below normal years, indicate that flow changes among months under the NEPA Modified Flow Alternative generally would be similar to those under the NEPA No Action Alternative during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the NEPA Modified Flow Alternative and the NEPA No Action Alternative, indicating that riparian habitat would not be exposed to overly stable flows under the NEPA Modified Flow Alternative. During dry and critical years, however, flows would have a slightly more stable flow regime under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative.

Analysis of model results indicates that long-term average end-of-month stages at Marysville under the NEPA Modified Flow Alternative generally would be similar, ranging from 0.4 feet higher during July and August to 0.2 feet lower during May and June, relative to the NEPA No Action Alternative. Average end-of-month stages by water year type also generally would be similar under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Specifically, average stages range from 0.6 feet higher during August of wet and above normal years to 0.8 feet lower during May of critical years (Appendix F4, 7 vs. 5, pg 321).

Monthly average stage decreases of 1 foot or more under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would occur at Marysville 1 time during April, 11 times during May, 3 times during June, while stage increases of 1 foot or more occur 7 times during July and August, and 3 times during September. Stages occurring outside the range of stages under the NEPA No Action Alternative would occur 9 times during April, 10 times during May, 18 times during June, 4 times during July, 3 times during August, and 7 times during September. In addition, stage differences of 1 foot or more would result in a stage outside the range of stages under the NEPA No Action Alternative 7 times (Appendix F4, 7 vs. 5, pgs 339-345).

Based on analysis of simulated flows and resultant stages at Marysville, long-term average flow and stage patterns, and flow and stage patterns during wet, above normal, and below normal, years, indicate that flow changes among months under the NEPA Modified Flow Alternative generally would be similar to those under the NEPA No Action Alternative during the riparian habitat analytical period. Generally, average flows would increase and decrease during similar times of the growing season under the NEPA Modified Flow Alternative and the NEPA No Action Alternative, indicating that riparian habitat would not be exposed to overly stable flows under the NEPA Modified Flow Alternative. During dry years, however, flows would have a slightly more stable flow regime under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. During critical years flows would not increase during May under the NEPA Modified Flow Alternative as they do under the NEPA No Action Alternative.

Model simulations of lower Yuba River flows and resultant stages indicate that relatively few differences in stage of 1 foot or more would result in a stage under the NEPA Modified Flow Alternative outside the range of stages under the NEPA No Action Alternative at Smartville or Marysville. Additionally, the pattern of flows and stages among months under the NEPA Modified Flow Alternative would be similar to those under the NEPA No Action Alternative. Therefore, implementation of the NEPA Modified Flow Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would be expected to have a less than significant impact on riparian habitat adjacent to the Yuba River that may be used by terrestrial resources.

Impact 11.2.9-4: Changes in Oroville Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value

Because releases from Oroville Reservoir are utilized to meet water quality and quantity requirements in the Delta, in response to water transfers from and flow requirements in the Yuba River, implementation of the NEPA Modified Flow Alternative could potentially impact reservoir shoreline vegetation and associated special-status species. However, water surface elevation fluctuations under the NEPA Modified Flow Alternative that would be within the range of water surface elevation fluctuations under the NEPA No Action Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir water surface elevation fluctuations under the NEPA Modified Flow Alternative are within the range of those under the NEPA No Action Alternative. Additionally, the shoreline of Oroville Reservoir is mostly devoid of vegetation, and specifically devoid of riparian and wetland vegetation, as a result of clearings and frequent water surface elevation fluctuations. Water surface elevation decreases resulting in end-of-month water surface elevations below those under the NEPA No Action Alternative would not substantially impact shoreline vegetation because those reductions would expose typically inundated shoreline and, therefore, would not dewater existing terrestrial vegetation. Water surface elevation increases under the NEPA Modified Flow Alternative resulting in end-of-month water surface elevations above those under the NEPA No Action Alternative would be expected to inundate shoreline vegetation, which could potentially impact special-status species.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the NEPA Modified Flow Alternative generally would be equivalent, but range from equivalent to 1 foot lower, relative to the NEPA No Action Alternative. Average end-of-month reservoir water surface elevations by water year type also generally would be equivalent under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Specifically, average reservoir water surface elevation ranges from equivalent during some months in all water years to 3 feet lower during May of critical years (Appendix F4, 7 vs. 5, pg 455).

End-of-month reservoir water surface elevations under the NEPA Modified Flow Alternative would be equivalent to those under the NEPA No Action Alternative approximately 74 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the NEPA Modified Flow Alternative are within the range of those under the NEPA No Action Alternative approximately 99 percent of the time. As such, end-of-month reservoir water surface elevation under the NEPA Modified Flow Alternative would be expected to decrease below the lowest end-of-month water surface elevations under the NEPA No Action Alternative approximately 1 percent of the time (1 time during each month from April through July and September). End-of-month reservoir water surface elevations would not be expected to increase above the highest end-of-month water surface elevations under the NEPA No Action Alternative during any month of the growing season (Appendix F4, 7 vs. 5, pgs 461-467).

The reservoir water surface elevation fluctuations that could be expected to occur under the NEPA Modified Flow Alternative are not expected to substantially impact shoreline vegetation because end-of-month water surface elevations generally are within the range of water surface elevations under the NEPA No Action Alternative. End-of-month water surface elevation decreases below the lowest water surface elevations under the NEPA No Action Alternative would expose additional shoreline, but would not desiccate existing shoreline or riparian vegetation with sufficient frequency to cause substantial impacts on riparian habitat. Additionally, end-of-month water surface elevations would not fluctuate above the highest reservoir water surface elevations under the NEPA No Action Alternative, which would not inundate shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on Oroville Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.9-5: Changes in the Oroville Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on Oroville Reservoir fish species, including bald eagles, potentially could be affected by implementation of the NEPA Modified Flow Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the NEPA Modified Flow Alternative would not significantly impact the warmwater or coldwater fisheries in Oroville Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in Oroville Reservoir associated with implementation of the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on terrestrial resources.

Impact 11.2.9-6: Changes in lower Feather River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the NEPA Modified Flow Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Feather River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the NEPA Modified Flow Alternative and the NEPA No Action Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that occur under the NEPA Modified Flow Alternative that would be within the range of stages under the NEPA No Action Alternative would not increase the inundation or desiccation frequency of lower Feather River riparian habitats.

Although flows and resultant stages under the NEPA Modified Flow Alternative that would be within the range of those under the NEPA No Action Alternative, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the NEPA No Action Alternative, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the NEPA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the NEPA No Action Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the NEPA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Feather River.

As such, stage changes resulting from implementation of the NEPA Modified Flow Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that occur within the range of stages that are expected to occur under the NEPA No Action Alternative would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the NEPA Modified Flow Alternative of 1 foot or more that also would result in stages outside the range of stages under the NEPA No Action Alternative could potentially impact riparian habitat along the lower Feather River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the NEPA Modified Flow Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Average monthly flows, and resultant stages, in the Feather River below the Fish Barrier Dam would be equivalent under the NEPA Modified Flow Alternative and the NEPA No Action Alternative for all months during the riparian habitat analytical period (Appendix F4, 7 vs. 5, pgs 547-553).

Analysis of model results indicates that long-term average end-of-month stages below Thermalito Afterbay generally would be similar under the NEPA Modified Flow Alternative, ranging from 0.1 feet higher during May to 0.1 feet lower during July, relative to the NEPA No Action Alternative. Average end-of-month stages by water year type generally would be similar under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Specifically, average stages range from 0.2 feet higher during critical years to 0.1 feet lower during above normal, below normal years, dry, and critical years (Appendix F4, 7 vs. 5, pg 652).

Monthly average stage decreases of 1 foot or more under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative would not occur below the Thermalito Afterbay, while stage increases of 1 foot or more occur 1 time during May. Stages occurring outside the range of stages under the NEPA No Action Alternative would not occur (Appendix F4, 7 vs. 5, pgs 670-676).

Based on analysis of simulated flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the NEPA Modified Flow Alternative and the NEPA No Action Alternative. Specifically, average flows at each location generally increase and decrease during similar time periods during the growing season, which indicates that riparian habitat would not be exposed to overly stable flows under the NEPA Modified Flow Alternative. As such, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the NEPA No Action Alternative also would be expected to increase and decrease during those same time periods under the NEPA Modified Flow Alternative. Because riparian species are adapted to the pattern of floodplain inundation and bench exposure to which they are exposed, and rely on those patterns for successful reproduction, the long-term average flow pattern and flow pattern by water year type under the NEPA Modified Flow Alternative would not substantially affect riparian species reproduction in the Feather River.

Model simulations of lower Feather River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the NEPA Modified Flow Alternative outside the range of stages under the NEPA No Action Alternative below the Thermalito Afterbay Outlet. Additionally, the pattern of flows and stages among months under the NEPA Modified Flow Alternative would be similar to those under the NEPA No Action Alternative. Therefore, implementation of the NEPA Modified Flow Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would be expected to have a less than significant impact on riparian habitat adjacent to the lower Feather River that may be used by terrestrial resources.

Impact 11.2.9-7: Changes in lower Sacramento River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation

Changes in flows and resultant stages associated with implementation of the NEPA Modified Flow Alternative could potentially impact riparian habitat as a result of extended desiccation of hydrophytic vegetation or extended inundation of non-hydrophytic riparian vegetation. Specifically, changes in flows could decrease stage sufficiently to desiccate wetland species or inundate terrestrial riparian vegetation. Based on the geomorphic characteristics of the lower Sacramento River and the locations of high quality riparian habitat, stage differences of less than 1 foot in magnitude between the NEPA Modified Flow Alternative and the NEPA No Action Alternative are not considered sufficiently large to inundate or desiccate substantial amounts of riparian habitat. Additionally, changes in flows and resultant stages that occur under the NEPA Modified Flow Alternative that would be within the range of stages under the NEPA No Action Alternative would not increase the inundation or desiccation frequency of lower Sacramento River riparian habitats.

Although flows and resultant stages under the NEPA Modified Flow Alternative that would be within the range of those under the NEPA No Action Alternative, or are less than 1 foot in magnitude, would not cause desiccation or inundation of additional riparian habitat, relative to the NEPA No Action Alternative, flow changes that result in additional habitat desiccation or inundation could occur. Specifically, stage changes under the NEPA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude and also would result in stages outside the range of those under the NEPA No Action Alternative could potentially impact riparian habitats. However, riparian habitats are adapted to periodic large stage fluctuations (i.e., greater than 1 foot). Therefore, infrequent stage fluctuations under the NEPA Modified Flow Alternative that are greater than or equal to 1 foot in magnitude would not substantially impact riparian habitats along the lower Sacramento River.

As such, stage changes resulting from implementation of the NEPA Modified Flow Alternative that would be less than 1 foot in magnitude, or stage changes equal to or greater than 1 foot that occur within the range of stages that are expected to occur under the NEPA No Action Alternative would not substantially impact riparian habitat. Additionally infrequent stage changes that are greater than 1 foot in magnitude also would not inundate or desiccate riparian habitat with sufficient frequency to be deleterious to riparian habitat. However, frequent stage changes under the NEPA Modified Flow Alternative of 1 foot or more that also would result in stages outside the range of stages under the NEPA No Action Alternative could potentially impact riparian habitat along the lower Sacramento River.

In addition to adapting to periodic stage fluctuations, riparian habitat also has adapted to the long-term hydrologic pattern of increased flows associated with winter precipitation and spring snowmelt runoff, and decreased flows associated with the summer dry period. Specifically, increasing flows that result in stages that potentially inundate floodplain habitat during April and May, and decreasing flows that result in stages that potentially expose benches during June through September are required for successful seed dispersal and sapling recruitment. Therefore, overly stable flows under the NEPA Modified Flow Alternative could potentially impact the reproductive cycle of riparian species by limiting periodic bench habitat exposure and re-flooding.

Analysis of model results indicates that long-term average end-of-month stages below the Feather River confluence under the NEPA Modified Flow Alternative generally would be similar, ranging from 0.2 feet higher during July and August to 0.1 feet lower during May and June, relative to the NEPA No Action Alternative. Average end-of-month stages by water year type also generally would be similar under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Specifically, average stages range from 0.3 feet higher during August of wet years to 0.4 feet lower during June of critical years (Appendix F4, 7 vs. 5, pg 931).

Monthly average stage increases or decreases of 1 foot or more under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would not occur below the Feather River confluence. Stages occurring outside the range of stages under the NEPA No Action Alternative would occur 1 time during May, 2 times during June, 1 time during July, and 2 times during September. However, no stage differences of 1 foot or more would result in a stage outside the range of stages under the NEPA No Action Alternative (Appendix F4, 7 vs. 5, pgs 949-955).

Based on analysis of simulated flows in the Sacramento River below Feather River confluence and at Freeport, long-term average flow patterns and flow patterns by water year type indicate that flow changes among months during the riparian habitat growing season generally would be similar under the NEPA Modified Flow Alternative and the NEPA No Action Alternative. Specifically, increasing flows that could potentially inundate floodplain habitat and decreasing flows that could expose benches under the NEPA No Action Alternative also would be expected to increase and decrease during those same time periods under the NEPA Modified Flow Alternative. Therefore, the long-term average flow pattern and flow pattern by water year type under the NEPA Modified Flow Alternative would not substantially affect riparian species reproduction in the Sacramento River.

Model simulations of lower Sacramento River flows and resultant stages indicate that no differences in stage of 1 foot or more would result in a stage under the NEPA Modified Flow Alternative outside the range of stages under the NEPA No Action Alternative below the Feather River confluence. Additionally, the pattern of flows and stages among months under the NEPA Modified Flow Alternative would be similar to those under the NEPA No Action Alternative. Therefore, implementation of the NEPA Modified Flow Alternative would not result in desiccation or inundation of substantial amounts of riparian habitat with sufficient frequency or sufficient duration, or expose riparian habitat to overly stable flows sufficient to substantially reduce growth or reproduction. As such, implementation of the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would be expected to have a less than significant impact on riparian habitat adjacent to the lower Sacramento River that may be used by terrestrial resources.

Impact 11.2.9-8: Changes in San Luis Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value.

Implementation of the NEPA Modified Flow Alternative could alter San Luis Reservoir water surface elevation, which could potentially impact shoreline vegetation and associated listed species. However, surface elevation fluctuations under the NEPA Modified Flow Alternative that would be within the range of surface elevation fluctuations under the NEPA No Action Alternative would not substantially impact shoreline vegetation. Riparian vegetation associated with tributaries feeding the reservoir also would not be expected to be impacted if reservoir surface elevation fluctuations under the NEPA Modified Flow Alternative are within the range of those under the NEPA No Action Alternative. Unlike most foothill reservoirs, San Luis Reservoir contains gently sloping shoreline upon which riparian vegetation can colonize. Reservoir operations maintain riparian vegetation along the shoreline of San Luis Reservoir perpetually in an early successional stage due to frequent surface elevation fluctuations. However, surface elevation reductions resulting in end-of-month surface elevations below those under the NEPA No Action Alternative would not substantially affect shoreline vegetation because those water surface elevation reductions would expose typically inundated shoreline and would not dewater existing terrestrial vegetation. Additionally, reservoir water surface elevation increases under the NEPA Modified Flow Alternative resulting in end-of-month surface elevations above those under the NEPA No Action Alternative would be expected to inundate shoreline vegetation. However, under those conditions reservoir operations would continue to maintain riparian habitat in an early successional stage.

Analysis of model results indicates that long-term average end-of-month reservoir water surface elevations under the NEPA Modified Flow Alternative generally would be similar, ranging from equivalent to 1 foot lower, relative to the NEPA No Action Alternative. Average end-of-month reservoir water surface elevations by water year type generally also are similar under the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative. Specifically, average reservoir water surface elevation ranges from equivalent during some months of all year types to 1 foot lower during below normal, dry, and critical years (Appendix F4, 7 vs. 5, pg 1413).

End-of-month reservoir water surface elevations under the NEPA Modified Flow Alternative would be equivalent to those under the NEPA No Action Alternative approximately 91 percent of the time during all months of the March through September growing season. End-of-month water surface elevations under the NEPA Modified Flow Alternative are within the range of those under the NEPA No Action Alternative 100 percent of the time. As such, end-of-month reservoir water surface elevation under the NEPA Modified Flow Alternative would not be expected to decrease below the lowest or increase above the highest end-of-month water surface elevations under the NEPA No Action Alternative during any month of the growing season (Appendix F4, 7 vs. 5, pgs 1419-1425).

The reservoir water surface elevation fluctuations that could be expected to occur under the NEPA Modified Flow Alternative are not expected to impact shoreline vegetation because end-of-month water surface elevations generally would be equivalent to those under the NEPA No Action Alternative. Additionally, when end-of-month reservoir water surface elevations under the NEPA Modified Flow Alternative and No Action Alternative are not equivalent, they would not fluctuate outside the range of water surface elevations under the NEPA No Action Alternative, which would not expose additional shoreline or inundate existing shoreline vegetation above the high water mark of the reservoir. Therefore, implementation of the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on Oroville Reservoir shoreline vegetation that may be used by terrestrial resources.

Impact 11.2.9-9: Changes in the San Luis Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality

Piscivorous birds that forage on San Luis Reservoir fishes potentially could be affected by implementation of the NEPA Modified Flow Alternative because impacts on reservoir fisheries associated with decreases in water surface elevation and cold water pool volume could potentially occur. Detailed analysis of potential impacts on reservoir fish species is presented in Chapter 10.

Implementation of the NEPA Modified Flow Alternative would not significantly impact warmwater or coldwater fisheries in San Luis Reservoir. Although the proportional contribution of each fishery to the overall composition of the piscivorous bird forage base is unknown and likely differs for each bird species, it is likely that piscivorous birds would experience minor changes in prey availability. Therefore, overall changes in the piscivorous bird forage base in San Luis Reservoir associated with implementation of the NEPA Modified Flow Alternative, relative to the NEPA No Action Alternative, would have a less than significant impact on terrestrial resources.

11.3 CUMULATIVE IMPACTS

Hydrologic modeling was used to evaluate the cumulative effects of the Yuba Accord Alternative and other likely changes in CVP/SWP operations on hydrology and water supply. The proposed projects that have been adequately defined (e.g., in recent project-level environmental documents or CALSIM II modeling) and that have the potential to contribute to cumulative impacts are included in the quantitative assessment of the Yuba Accord's impacts. For analytical purposes of this EIR/EIS, the projects that are considered well defined and "reasonably foreseeable" are described in Chapter 21. Additionally, the assumptions used to categorize future hydrologic cumulative conditions that are quantitatively simulated using CALSIM II and the post-processing tools are presented in Appendix D. To the extent feasible, potential cumulative impacts on resources dependent on hydrology or water supply (e.g., reservoir surface elevations) are analyzed quantitatively. Because several projects cannot be accurately characterized for hydrologic modeling purposes at this time, either due to the nature of the particular project or because specific operations details are only in the preliminary phases of development, these projects are evaluated qualitatively.

Only those projects that could affect surface water quality are included in the qualitative evaluation that is presented in subsequent sections of this chapter. Although most of the proposed projects described in Chapter 21 could have project-specific effects that will be addressed in future project-specific environmental documentation, future implementation of these projects is not expected to result in cumulative impacts to regional water supply operations, or water-related and water dependent resources that also could be affected by the Proposed Project/Action or the action alternatives (see Chapter 21). For this reason, only the limited number of projects with the potential to cumulatively impact terrestrial resources in the project study area are specifically considered qualitatively in the cumulative impacts analysis for terrestrial resources. These projects are:

- ❑ Water Storage and Conveyance Projects
  - Shasta Lake Water Resources Investigation (Shasta Reservoir Enlargement)
  - Upstream of Delta Off-Stream Storage (Sites Reservoir)
  - In-Delta Storage Program (Delta Wetlands Project)
  - Los Vaqueros Reservoir Expansion Project
  - Folsom Dam Raise Project
- ❑ Projects Related to Changes in CVP/SWP System Operations
  - Long-Term CVP and SWP Operations Criteria and Plan
  - Delta Cross Channel Re-operation and Through-Delta Facility
  - CVP/SWP Integration Proposition
  - Isolated Delta Facility
  - Central Valley Project Long-Term Contract Renewals
  - San Joaquin Valley/Southern California Water Exchange Program
  - City of Stockton Delta Water Supply Project
  - Sacramento River Water Reliability Study
  - South Delta Improvements Program
  - Oroville Facilities FERC Relicensing
- ❑ Water Transfer and Acquisition Programs
  - Dry Year Water Purchase Program
  - Sacramento Valley Water Management Program
  - South-of-Delta Water Banking: Madera Irrigation District Water Banking Project
  - South of Delta Water Banking: Semitropic Water Storage District Groundwater Banking Project
- ❑ Flood Control, Ecosystem Restoration and Fisheries Improvement Projects
  - CALFED Ecosystem Restoration Program
- ❑ Local Projects in the Yuba Region
  - Yuba River Development Project FERC Relicensing

These projects are described in Chapter 21 and qualitatively addressed below.

11.3.1 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE YUBA ACCORD ALTERNATIVE CUMULATIVE CONDITION COMPARED TO THE EXISTING CONDITION

For CEQA, the purpose of the cumulative analysis is to determine whether the incremental effects of the Proposed Project (Yuba Accord Alternative) would be expected to be "cumulatively considerable" when viewed in connection with the effects of past projects, other current projects, and probable future projects (Public Resources Code Section 21083, subdivision (b)(2)).[10]

For NEPA, the scope of an EIS must include "*cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement*" (40 CFR,§1508.25(a)(2)).

Because the CEQ regulations implementing NEPA and the CEQA guidelines contain very similar requirements for analyzing, and definitions of, cumulative impacts, the discussions of cumulative impacts of the Yuba Accord Alternative Cumulative Condition relative to the Existing Condition will be the basis for evaluation of cumulative impacts for both CEQA and NEPA. In addition, an analysis of the Modified Flow Alternative Cumulative Condition relative to the Existing Condition is provided to fulfill NEPA requirements.

The following sections describe this analysis for the projects discussed in Section 11.3 above.

11.3.1.1 WATER STORAGE AND CONVEYANCE PROJECTS

Many of the CALFED Programs described in Chapter 21 and listed above would result in land-based changes that could impact vegetation and wildlife resources. Development of new water storage reservoirs could increase the availability of aquatic habitat available to existing wildlife and attract other species (e.g., waterfowl) into an area. While these projects may be beneficial for wildlife species that are attracted to aquatic habitats, such project also could be detrimental to terrestrial species that are primarily dependent on upland habitats such as grasslands or woodlands. For example, construction of Sites Reservoir, if implemented, would inundate hundreds of acres of habitats including annual grasslands, some of which support vernal pools, riparian woodlands, chaparral and oak woodland (Reclamation and DWR 2005). Thus, there would be both positive and negative effects that would vary depending on the habitat requirements for a particular species. Potential factors that may contribute to cumulative effects in the future may include reduced habitat abundance, impaired species movement, and geographic relocation and/or restriction to less suitable habitats.

Expansion of existing water storage facilities would be expected to increase inundation of existing reservoir shoreline habitats, particularly when reservoir storage volumes approach maximum levels. While these actions could create additional cold- and warmwater fisheries habitats within reservoirs (e.g., Shasta or Folsom), they also may remove or reduce the amount of riparian and upland habitats currently available for wildlife use immediately adjacent to

[10] The "*Guide to the California Environmental Quality Act*" (Remy *et. al.* 1999) states that "*…although a project may cause an "individually limited" or "individually minor" incremental impact that, by itself, is not significant, the increment may be "cumulatively considerable", and thus significant, when viewed against the backdrop of past, present, and probable future projects.*" (CEQA Guidelines, § 15064, subd. (i)(l), 15065, subd. (c), 15355, subd. (b)).

reservoirs. In the Delta, shallow water management activities[11] associated with in-Delta storage could enhance forage and cover for wintering waterfowl between September and May (USFWS 1997).

The geographic range in which the Yuba Accord Alternative could alter hydrologic conditions affecting terrestrial resources in the project study area would be limited to the Yuba, Feather and Sacramento rivers, and possibly the Delta. Most of the reasonably foreseeable water storage projects would not be located in the immediate vicinity of these water bodies, and the potentially affected habitats are not contiguous.

11.3.1.2 PROJECTS RELATED TO CVP/SWP SYSTEM OPERATIONS

Cumulative changes in operations of future projects associated with the CVP/SWP system could result in cumulative operational changes for the CVP, SWP, and local water supply systems, and could result in new diversions from upstream or Delta sources. The specific operational changes that could result from the range of future storage and conveyance projects currently contemplated are in the process of being identified and will evolve over time. The general changes that may occur and that could affect special-status and other terrestrial species include:

- Increased surface water diversion and storage;
- Improved water supply reliability and water management flexibility;
- Requirements for compatibility with objectives and continued improvement of Delta water quality; and
- Improvements in flood conveyance in the north Delta and lower San Joaquin River.

Projects related to CVP/SWP system operations have the potential to result in changes in reservoir storage volumes, river flows and water temperatures, and Delta conditions. CVP/SWP system operational changes could affect north of Delta hydrology by altering flow and water temperature patterns (timing, magnitude and frequency), as well as Delta inflows, outflows, X2 location and exports. The potential exists for reduced stream flows, Delta outflow, changed seasonal flow, water temperature variability, and changes in Delta salinity conditions that could result in effects to aquatic habitats and riparian areas used by wildlife. Potential factors that may contribute to cumulative effects in the future may include reduced habitat abundance, impaired species movement, and geographic relocation and/or restriction to less suitable habitats.

11.3.1.3 WATER TRANSFER AND ACQUISITION PROGRAMS

Several water projects (e.g., SVWMP, Dry Year Water Purchase Program, CVPIA Water Acquisition Program, in addition to the EWA) could purchase water through groundwater substitution programs. Groundwater substitution programs would involve groundwater actions based on individual environmental documents required for the use of CVP and SWP facilities. The oversight of water transfers by Reclamation and DWR would ensure that the effects on wetlands and other vegetation communities because of groundwater substitution actions would be avoided or minimized. In addition to groundwater substitution programs,

[11] During periods of non-storage, portions of the habitat islands and reservoir islands could be flooded to shallow depths during the winter to attract wintering waterfowl and support private hunting clubs (USFWS 1997).

some reasonably foreseeable acquisition programs may include crop idling practices. However, groundwater substitutions under the Yuba Accord Alternative would be restricted to the Yuba Region, would only occur during certain years, and would not involve any crop idling activities associated with this alternative.

11.3.1.4 FLOOD CONTROL, ECOSYSTEM RESTORATION AND FISHERIES IMPROVEMENT PROJECTS

Flood control, ecosystem restoration and fisheries improvement projects would be targeted to improve aquatic habitat conditions within the project study area. Implementation of other projects, in addition to the Yuba Accord Alternative, could improve instream flow and water temperature conditions, physical habitat availability and ecosystem functions. Over time, habitat restoration actions could improve floodplain development by increasing riparian and wetland habitats, and thereby increasing habitat complexity and diversity. A number of contemplated ecosystem restoration and fisheries improvement projects are intended to improve, in part, Delta habitat and conditions for fish and wildlife. Although these projects may result in some temporary disturbance of Delta waterways and habitat, these potential short-term cumulative effects would be less than significant, and long-term habitat improvement actions would be beneficial for the aquatic ecosystem and wildlife species that may utilize these areas.

11.3.1.5 OTHER CUMULATIVE TERRESTRIAL RESOURCES IMPACT CONSIDERATIONS

The quantitative operations-related impact considerations for the CEQA Yuba Accord Alternative, relative to the CEQA Existing Condition, are discussed in Section 11.2.5. Potential impacts identified in Section 11.2.5 are summarized below and provide an indication of the potential incremental contributions of the Yuba Accord Alternative to cumulative impacts. These potential impacts are summarized here:

- Impact 11.2.5-1: Changes in New Bullards Bar Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value – Less than Significant
- Impact 11.2.5-2: Changes in the New Bullards Bar Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality – Less than Significant
- Impact 11.2.5-3: Changes in lower Yuba River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation – Less than Significant
- Impact 11.2.5-4: Changes in Oroville Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value – Less than Significant
- Impact 11.2.5-5: Changes in the Oroville Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality – Less than Significant
- Impact 11.2.5-6: Changes in lower Feather River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation –Less than Significant

- Impact 11.2.5-7: Changes in lower Sacramento River flow during the March through September period that could degrade the growth, maintenance, and reproductive capacity of riparian vegetation – Less than Significant
- Impact 11.2.5-8: Changes in San Luis Reservoir water surface elevations during the March through September period that could degrade continuous strands of native vegetation of relatively high to moderate wildlife value – Less than Significant
- Impact 11.2.5-9: Changes in the San Luis Reservoir fishery during the April through July period that could degrade piscivorous bird forage quantity or quality – Less than Significant

Although these impacts would be less than significant, the potential exists for cumulative impacts. Cumulative impact determinations are presented below, and are based upon consideration of the quantified Yuba Accord Alternative impacts relative to the Existing Condition, in combination with the potential impacts of other reasonably foreseeable projects. These cumulative impact determinations are summarized by region.

11.3.1.6 Potential for Cumulative Terrestrial Resources Impacts Within the Project Study Area

Results from the quantitative analysis generally indicate that direct project-related impacts on terrestrial resources would be less than significant. Nevertheless, the Yuba Accord Alternative still could incrementally contribute to cumulative terrestrial resources impacts within the project study area. The frequency and magnitude of the quantitative hydrologic changes associated with the Yuba Accord Alternative and the other qualitative analytical considerations discussed above both were considered during the development overall cumulative impact conclusions discussed below for the Yuba Accord Alternative Cumulative Condition, relative to the Existing Condition.

Impact 11.3.1.6-1: Potential for significant cumulative terrestrial resources impacts within the Yuba Region

Of the projects discussed above, only the Yuba River Development Project FERC Relicensing has the potential to affect future terrestrial resources conditions in the Yuba Region. While, as part of the relicensing, FERC may impose new regulatory constraints on the Yuba Project, which could affect New Bullards Bar Reservoir operations and YCWA's ability to manage releases into the lower Yuba River, it is not anticipated that FERC's new conditions would significantly affect terrestrial resources. The overall effects on terrestrial resources in the Yuba Region therefore would be minor, and the impacts on terrestrial resources within the Yuba Region of the Yuba Accord Alternative Cumulative Condition, compared to the Existing Condition, would be less than significant.

Impact 11.3.1.6-2: Potential for significant cumulative terrestrial resources impacts within the CVP/SWP Upstream of the Delta Region

For the reasons discussed above, it is anticipated that the overall effect of new water storage and conveyance projects, new water transfer and acquisition programs and new flood control, ecosystem restoration and fisheries improvement projects could contribute to potentially significant cumulative impacts on terrestrial resources in the CVP/SWP Upstream of the Delta Region. The Yuba Accord Alternative's incremental contribution to these cumulative impacts would be minimal and primarily would affect riverine conditions and riparian habitats through small changes (e.g., a few inches) in river stage, which would not be expected to contribute to cumulative impacts on terrestrial resources, except with those projects that are within reasonable proximity to the Feather and Sacramento rivers. Collectively, potential changes in hydrologic conditions (e.g., stage) associated with the Yuba Accord Alternative, in addition to similar types of changes resulting from other projects in response to increased system demands, may contribute to cumulative riparian habitat impacts by increasing the inundation or desiccation frequency of riparian habitats along the lower Feather and Sacramento rivers. Significant cumulative effects on riparian habitats and terrestrial resources could be either positive or negative, depending on the overall timing and operation of other reasonably foreseeable projects (most of which are still in planning stages) that would occur in combination with the Yuba Accord Alternative. However, in the absence of more definitive or quantitative information regarding the overall effects of future CVP/SWP system operations on river stage, a conservative analytical interpretation is made, which concludes that the incremental contribution of the Yuba Accord Alternative, when combined with the effects of other projects, may result in a potentially significant and unavoidable cumulative impact on terrestrial resources in the CVP/SWP Upstream of the Delta Region.

Impact 11.3.1.6-3: Potential for significant cumulative terrestrial resources impacts within the Export Service Area

As discussed above in Sections 11.2.5 and 11.2.8, reservoir operations maintain riparian vegetation along the shoreline of San Luis Reservoir perpetually in an early successional stage due to frequent surface elevation fluctuations. Water surface elevation reductions resulting from changes in San Luis Reservoir releases to meet increased future demands would not substantially affect shoreline vegetation because those water surface elevation reductions would expose typically inundated shoreline and, therefore, will not dewater existing terrestrial vegetation. San Luis Reservoir currently is a regulating facility for south-of-Delta deliveries and is expected to continue as such in the future with similar operational constraints, such as San Luis Reservoir low point control. Future San Luis Reservoir operations would be expected to cause fluctuations (increases and decreases) in water surface elevations, as well as changes in storage, that will be within the range of historical variations and, thus, these changes will remain within the range of seasonal drawdown levels under the Existing Condition. Because reservoir drawdowns would not increase beyond the range of current reservoir operations, it is anticipated that the new projects discussed above would not adversely impact terrestrial resources in or around San Luis Reservoir. Therefore, the overall effects on terrestrial resources associated with San Luis Reservoir would be minor, and the potential cumulative impacts of the Yuba Accord Alternative Cumulative Condition, relative to the Existing Condition, would be less than significant.

11.3.2 ENVIRONMENTAL IMPACTS/ENVIRONMENTAL CONSEQUENCES OF THE MODIFIED FLOW ALTERNATIVE CUMULATIVE CONDITION COMPARED TO THE EXISTING CONDITION

It is anticipated that the Modified Flow Alternative Cumulative Condition will have the same potential for cumulative impacts as the Yuba Accord Alternative Cumulative Condition. Therefore, the description of the potential impacts in Section 11.3.1 also serves as the description of cumulative impacts associated with the Modified Flow Alternative. Thus, the Modified Flow Alternative Cumulative Condition would result in the following potential cumulative impacts:

- Yuba Region - Potential cumulative impacts on terrestrial resources in the Yuba Region would be less than significant.
- CVP/SWP Upstream of the Delta Region - Potential cumulative impacts on terrestrial resources in the CVP/SWP Upstream of the Delta Region could be potentially significant and unavoidable.
- Export Service Area - Potential cumulative impacts on terrestrial resources in the Export Service Area (San Luis Reservoir) would be less than significant.

11.4 POTENTIAL CONDITIONS TO SUPPORT APPROVAL OF YCWA'S WATER RIGHTS PETITION

No unreasonable adverse effects to terrestrial resources would occur under the Proposed Project/Action or an action alternative and, thus, no impact avoidance measures or other protective conditions are identified for the SWRCB's consideration in determining whether or not to approve YCWA's petitions to implement the Yuba Accord.

11.5 MITIGATION MEASURES/ENVIRONMENTAL COMMITMENTS

No adverse effects would occur to terrestrial resources under the Proposed Project/Action or and action alternative and, thus, no mitigation measures are required.

11.6 POTENTIALLY SIGNIFICANT UNAVOIDABLE IMPACTS

There are no potentially significant unavoidable project-related impacts to terrestrial resources associated with the implementation of the Proposed Project/Action or an action alternative. However, the Yuba Accord Alternative, in combination with other future projects, may result in a potentially significant unavoidable cumulative impact on terrestrial resources in the CVP/SWP Upstream of the Delta Region due to the combined effects of multiple projects on river stage in the lower Feather and Sacramento rivers. Similarly, the Modified Flow Alternative, in combination with other reasonably foreseeable future projects, could result in potentially significant unavoidable cumulative impacts on terrestrial resources in the CVP/SWP Upstream of the Delta Region and the Delta Region.