Chapter 5
Water Supply

5.1 Environmental Setting/Affected Environment

This section provides a description of the environmental setting/affected environment related to water supply that may be influenced by implementation of the Bay Delta Conservation Plan (BDCP) alternatives, including possible changes to water supply conditions. The study area (area in which impacts may occur) for the water supply analysis includes the Plan Area (the area covered by the BDCP); which is largely formed by the statutory borders of the Sacramento–San Joaquin River Delta (Delta), along with areas in Suisun Marsh and the Yolo Bypass; areas upstream of the Delta region that may experience changes in operations as a result of implementation of the BDCP alternatives; and the State Water Project (SWP) and Central Valley Project (CVP) Service Areas. The information presented in the Environmental Setting/Affected Environment section is based upon conditions in 2009, the publication date of the Notice of Preparation/Notice of Intent.

Water supplies and approaches to water supply management vary significantly throughout California depending on supply sources and on various urban, agricultural, and environmental water needs. The study area for the water supply analysis includes the Delta region, areas upstream of the Delta region that may experience changes in operations as a result of implementation of the BDCP alternatives, and the SWP and CVP Service Areas. The Delta watershed includes the tributary rivers that flow into the Delta from the Sacramento River and the San Joaquin River basins. In general, the Delta watershed is represented by the drainage of the Central Valley except for the Tulare Lake area. Areas outside of the Delta that receive Delta water include Tulare Lake, San Francisco Bay, Central Coast, and Southern California. Figure 1-2 in Chapter 1, *Introduction,* shows the major SWP and CVP water supply infrastructure. Figure 1-3 shows the SWP and CVP service areas.

Other topics related to water supply are addressed in other chapters. Chapter 6, *Surface Water*, describes waters of the Sacramento River and the San Joaquin River basins, including the Delta and Suisun Marsh, that could be directly or indirectly affected by SWP and CVP operations and implementation of the habitat restoration in the Restoration Opportunity Areas (ROAs) identified in BDCP alternatives. Chapter 7, *Water Quality*, describes surface water quality in the Sacramento and San Joaquin River basins. Chapter 8, *Groundwater*, describes groundwater characteristics in the Sacramento and San Joaquin River basins. Chapter 30, *Growth Inducement and Other Indirect Effects*, describes potential effects on urban areas caused by changes in SWP and CVP water supply deliveries.

5.1.1 Overview of California Water Resources

Variability and uncertainty are the dominant characteristics of California's water resources. As described in Chapter 6, *Surface Water*, and Chapter 7, *Groundwater*, California's water resources vary dramatically geographically across the state due to extreme differences in precipitation conditions as described below.

5.1.1.1 Historical Precipitation Patterns

Precipitation is the source of 97% of California's water supply. It varies greatly from year to year, by season, and by where it falls geographically in the state. With climate change, the state's precipitation is expected to become even more unpredictable.

In an average water year, precipitation provides California with about 200 million acre-feet (MAF) of water falling as either rain or snow (California Department of Water Resources 2009).[1] However, the total volume of water the state receives can vary dramatically between dry and wet years. California may receive less than 100 MAF of water during a dry year and more than 300 MAF in a wet year (Western Regional Climate Center 2011). Out of all precipitation that California receives, over half evaporates,[2] which leaves about 40–50% of the water available for management and use in urban areas, agriculture, and for environmental purposes, collectively.

The geographic variation and the unpredictability in precipitation that California receives make it challenging to manage the available runoff that can be diverted or captured in storage to meet urban and agricultural water needs. The majority of California's precipitation occurs between November and April, yet most of the state's demand for water is in the hot, dry summer months. In addition, most of the precipitation falls in the mountains in the northern half of the state, far from major population and agricultural centers. In some years, the far north of the state can receive 100 inches or more of precipitation, while the southernmost regions receive only a few inches (Western Regional Climate Center 2011). Figure 5-1 shows the distribution of precipitation across the state.

The historical record also shows that California has frequently experienced multi-year droughts, as well as extremely wet years that coincide with substantial flooding. Between 1906 and 1960, one-third of the water years in California have been considered by DWR to have been "dry or critically dry"; this has increased to 37% since 1960, which is consistent with the predicted effects of climate change on California (California Department of Water Resources 2011a).

Historically, precipitation in most of California has been dominated by extreme variability seasonally, annually, and over decade time scales; in the context of climate change, projections of future precipitation are even more uncertain than projections for temperature. Uncertainty regarding precipitation projections is greatest in the northern part of the state, and a stronger tendency toward drying is indicated in the southern part of the state. Climate models project more extreme winter precipitation events and a more rapid spring melt leading to a shorter, more intense spring period of river flow and freshwater discharge.

With the growing limitations on available surface water and the potential impacts of climate change, conjunctive management of surface water and groundwater resources is more important for meeting the state's water needs.

5.1.1.2 Developed Water Supplies

Historically, local water resources constituted the backbone of California's water supply reliability. Local surface storage and deliveries, together with reuse, account for about 40% of the state's

[1] Includes up to 10 MAF of water flowing into California from Oregon, Mexico, and the Colorado River.

[2] Includes evaporation, evapotranspiration of native vegetation, groundwater subsurface outflows, and other losses (California Department of Water Resources 2009).

developed water supplies. Groundwater is also a significant resource, supplying about 35% of the state's water needs, and during droughts, 40% or more. Imported water from the Colorado River provides 10% of the state's developed water supply, serving communities in Southern California. A small amount is attributed to recycled water and other local reuse projects (California Department of Water Resources 2009).

Surface Water

In California, winter precipitation and spring snowmelt are captured in surface water reservoirs to provide flood protection and water supply. The state's largest surface "reservoir" is the Sierra Nevada snowpack, which holds about 15 MAF of water on average (California Department of Water Resources 2009).

To cope with the state's hydrologic variability and also manage floods during wet years, State, federal, and local agencies have constructed a vast interconnected system of surface reservoirs, aqueducts, and water diversion facilities. This system helps California to store and convey water supplies from areas that have water available to areas that have water needs. In most regions of the state, these imported water supplies supplement local and regional water sources.

California depends on these statewide water management systems to provide clean and reliable water supplies, protect lives and property from floods, endure drought, and sustain environmental values. These water management systems include physical facilities and their operational policies and regulations, and include more than 1,200 State, federal, and local reservoirs, as well as canals, treatment plants, and levees. Thousands of miles of canals and large pumps have been constructed to move water around the state. The first major regional storage and conveyance projects were developed to store and convey water from the Delta watershed in the Sierra Nevada and from the Owens Valley to the rapidly growing regions in the San Francisco Bay Area and Southern California, respectively.[3] The state's largest projects are the SWP and the CVP, which were mostly constructed between 1930 and 1970. These projects were designed to export water from the Delta watershed and provide supplemental water for agricultural and urban uses, primarily in the Central Valley and Southern California.

Groundwater

Groundwater occurs throughout the Central Valley, the southeast desert, and in isolated basins on the coast. DWR has delineated 515 distinct groundwater systems as described in Bulletin 118-03 (California Department of Water Resources 2003). These basins and subbasins have various degrees of supply reliability in terms of yield, storage capacity, and water quality. This section provides a brief overview of California groundwater resources related to water supply. Chapter 7, *Groundwater*, provides a detailed description of groundwater resources in the study area.

The importance of groundwater as a resource varies regionally. The Central Coast Hydrologic Region has the most reliance on groundwater to meet its local uses, with more than 80% of its water use supplied by groundwater in an average year. The Tulare Lake Hydrologic Region meets about

[3] These included the San Francisco Public Utilities Commission's Hetch Hetchy Project, Los Angeles' Owens Valley and Mono Basin Aqueduct, and the East Bay Municipal Utility District's Mokelumne Aqueduct. Additional projects that brought Colorado River water into California were the Imperial Irrigation District's All-American Canal and the Metropolitan Water District of Southern California's Colorado River Aqueduct.

50% of its local uses with groundwater extraction. The rest of the Central Valley meets between 15 and 35% of local uses with groundwater. In Southern California, the use of groundwater varies between 15 to 35% of annual use (South Coast Hydrologic Region) and 70% of annual use (South Lahontan Hydrologic Region). In general, of all the groundwater extracted annually in the state in an average year, more than 35% is produced in the Tulare Lake Hydrologic Region, and more than 70% occurs in the Central Valley (California Department of Water Resources 2009).

During droughts, California has historically depended upon groundwater. Groundwater resources will not be immune to climate change; in fact, historical patterns of groundwater recharge may change considerably. Because droughts may be exacerbated by climate change, efficient groundwater basin management will be necessary to avoid additional overdraft and to take advantage of opportunities to store water underground and eliminate existing overdraft.

A comprehensive assessment of overdraft in the state's groundwater basins has not been conducted since Bulletin 118-80 in 1980, but overdraft is estimated at between 1 to 2 MAF annually (California Department of Water Resources 2003). In DWR's Bulletin 118-80 (California Department of Water Resources 1980), an assessment of critically overdrafted basins was conducted. Several basins were identified as being in a critical condition of overdraft, and a number of these basins are located in the Tulare Lake Basin.

Water Reuse

Recycled water is used for groundwater recharge, repelling seawater intrusion, landscape irrigation, and industrial, agricultural, and environmental, uses. To date, the majority of recycled water projects have occurred by retrofitting existing facilities. Retrofitting is expensive, can conflict with existing infrastructure, and may cause a disruption for the public. For new developments, dual plumbing of homes and facilities makes implementing recycled water use more cost-effective. Another area of emerging water reclamation is agricultural drain water.

5.1.1.3 Overview of California Water Demand

Limitations on available surface water, groundwater, and the potential impacts of climate change pose significant challenges to meeting the state's water demands. Population growth is a major factor influencing current and future water uses. From 1990 to 2005, California's population increased from about 30 million to about 36.5 million (California Department of Water Resources 2009). The California Department of Finance projects that this trend means a state population of roughly 60 million by 2050. Even with increased conservation and recycling the state's urban water demands are increasing.

California is one of the most productive agricultural regions in the world. Agriculture is an important element of California's economy, with 88,000 farms and ranches generating $32 billion in gross income in 2006, according to the California Department of Food and Agriculture and generating $100 billion in related economic activity. In 2000, California irrigated an estimated 9.6 million acres of cropland (includes multicropping) using roughly 34 MAF of applied water. Table 5-1 shows the distribution of water demand across the state.

Another important factor affecting current and future water uses is the dedication of water to meet environmental needs. For example, recent biological opinions (BiOps) developed by the U.S. Fish and Wildlife Service (USFWS) (2008) and by the National Marine Fisheries Service (NMFS) (2009), Consistency Determinations by the California Department of Fish and Wildlife, implementation of the Bay-Delta Water Quality Control Plan by the California State Water Resources Control Board (State Water Board), and the Central Valley Project Improvement Act (CVPIA) have directly and indirectly resulted in the dedication of water to fish, wildlife, and habitat restoration. This dedication is accomplished by releasing water from upstream reservoirs for in-river and Delta outflow requirements and by reducing exports from the south Delta pumping plants during specific times, among other actions (California Department of Water Resources 2009).

Table 5-1. Distribution of State Precipitation and Water Demand (thousand acre-feet)

Hydrologic Region	Precipitation Amount	Consumptive Use[a]
North Coast	64,296	617
San Francisco Bay	8,047	395
Central Coast	13,737	708
South Coast	15,344	1,515
Tulare Lake	16,939	6,655
San Joaquin River	27,903	4,512
Sacramento River	69,646	4,707
North Lahontan	8,992	294
South Lahontan	17,255	296
Colorado River	9,755	2,356

Source: California Department of Water Resources 2009a.

[a] Consumptive use (includes agricultural, industrial, municipal, and wetlands) is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

Californians are able to meet water demands primarily through an extensive network of water storage and conveyance facilities, groundwater development, and by improving water use efficiency. The state's water resources are variable, and agricultural, urban, and environmental water uses all vary according to the wetness or dryness of a given year. In very wet water years with excessive precipitation, agricultural and urban landscape (outdoor) water demands are lower due to the high amount of rainfall that directly meets the needs. Water demands are usually highest during average to below-average water years in which agricultural and outdoor water uses are at full deployment. During the very dry water years, demands for water are reduced as a result of urban and agriculture water conservation practices because available surface water supplies are very limited under these dry hydrologic conditions.

5.1.2 SWP and CVP Facilities and Operations

DWR and the Bureau of Reclamation (Reclamation) operate the SWP and the CVP, respectively, to divert, store, and convey SWP and CVP water consistent with applicable laws and contractual obligations and facility capacity. The SWP and the CVP are major water storage and delivery systems that divert water from the southern portion of the Delta. The SWP and CVP both include major reservoirs upstream of the Delta and transport water via natural watercourses and canal systems to areas south and west of the Delta. The CVP also includes facilities and operations on the Stanislaus and San Joaquin rivers.

The projects operate under water rights permits and decisions issued by the State Water Board. Under these permits and decisions, the SWP and CVP store water during wet periods, divert surplus water that reaches the Delta, and divert SWP and CVP water that has been stored in upstream reservoirs. Surplus water is defined as water that is not needed to meet senior water rights or regulatory flow and water quality requirements. Both projects operate pursuant to water right permits and licenses issued by the State Water Board to appropriate water by diverting to storage or by directly diverting to use and diverting releases from storage later in the year. As conditions of the projects' water right permits and licenses, the State Water Board requires the SWP and CVP to meet specific water quality, quantity, and operational criteria upstream and within the Delta. Reclamation and DWR closely coordinate the SWP and CVP operations, respectively, to meet these conditions. Figure 1-2 shows the major facilities of the SWP and CVP and Figure 1-3 shows the associated service areas.

Operations of the SWP and CVP are also operated in accordance with the Coordinated Operations Agreement, as described in Section 5.1.2.3, and BiOps issued by USFWS and NMFS for the coordinated long-term operations of the SWP and CVP, as described in Section 5.2.1.1. Both projects are operated pursuant to rules promulgated through a variety of agency jurisdictions and authorities, including ESA, CESA, water rights, SWRCB permits and licenses, the Clean Water Act, and the Porter-Cologne Act.

5.1.2.1 CVP Facilities

The CVP is the largest federal Reclamation project. It was originally authorized by the state legislature and voters of California through the passing of the California Central Valley Project Act in 1933. Shortly thereafter, California ceded control of the project to the federal government to maximize federal financial contributions during the Great Depression.

The federal government assumed control of the project through the Rivers and Harbors Act of 1935. and Reclamation was authorized to construct the project. When the Rivers and Harbors Act was reauthorized in 1937, the project became subject to Reclamation law, and its purposes were for "improving navigation, regulating the flow of the San Joaquin River and the Sacramento River, controlling floods, providing for storage and for the delivery of stored Waters." Subsequent reauthorizations and legislation added additional purposes, including the 1992 CVPIA, which modified the 1937 Act and added mitigation, protection, and restoration of fish and wildlife as project purposes. Further, the CVPIA specified that the dams and reservoirs of the CVP should now be used "first, for river regulation, improvement of navigation, and flood control; second, for irrigation and domestic uses and fish and wildlife mitigation, protection and restoration purposes; and, third, for power and fish and wildlife enhancement."

Following the construction of the Friant Dam in 1942 and the Friant-Kern Canal in 1948, the CVP began diverting SJR water to supply irrigators on the east side of the SJV. Subsequent projects on the west side on the Sac Valley, notably the TC Canal in 1980, increased capacity for upstream diversions from the SR. The CVP's major water storage facilities are located at the Shasta, Trinity, Folsom, and New Melones Dams. The primary water pumping facility for the CVP to export water

South of the Delta is the Jones Pumping Plant, which is located west of the City of Tracy (Chapter 4 of the BDCP[4]).

The CVP presently consists of 18 dams and reservoirs, 11 power plants, and 500 miles of major canals as well as conduits, tunnels, and related facilities. These facilities provide sufficient quantities of water to irrigate approximately one-third of the agricultural land of CA and to provide for municipal and industrial use to support close to 1 million households for 1 year. Over 250 contractors in 29 out of 58 counties in CA have entered into long-term contracts for CVP water (Chapter 4 of the BDCP). The following sections provide a description of the major CVP facilities by operating division.

Trinity River Division

Completed in 1964, the Trinity River Division includes facilities to store and regulate water in the Trinity River and facilities to divert water to the Sacramento River Basin. Trinity Dam is located on the Trinity River and regulates flow from a drainage area of approximately 720 square miles. The dam was completed in 1962, forming Trinity Lake, which has a maximum storage capacity of approximately 2.4 MAF. The mean annual inflow to Trinity Lake from the Trinity River is about 1.2 MAF per year. Historically, an average of about two-thirds of the annual inflow has been diverted to the Sacramento River Basin (1991–2003). Trinity Lake stores water for release to the Trinity River and for diversion to the Sacramento River via Lewiston Reservoir, Clear Creek Tunnel, Whiskeytown Reservoir, and Spring Creek Tunnel, where it commingles in Keswick Reservoir with Sacramento River water that was released from Shasta Dam and Spring Creek Debris Dam.

Periodically, increased water releases are made from Trinity Dam consistent with Reclamation Safety of Dams criteria intended to prevent dam overtopping. Although flood control is not an authorized purpose of the Trinity River Division, flood control benefits are provided through normal operations.

Based on the Trinity River Main-stem Fishery Restoration Record of Decision (ROD), dated December 19, 2000, from 368,600 acre-feet (af) to 815,200 af is allocated annually for Trinity River flows. This amount is scheduled in coordination with the USFWS to best meet habitat, temperature, and sediment transport objectives in the Trinity Basin. Temperature objectives for the Trinity River are set forth in State Water Board order WR 90-5.

Diversion of Trinity water to the Sacramento Basin provides limited water supply and hydroelectric power generation for the CVP and assists in water temperature control in the Trinity River and upper Sacramento River. The seasonal timing of Trinity exports is a result of determining how to make best use of a limited volume of Trinity export (in concert with releases from Shasta) to help conserve and manage cold water pools and meet temperature objectives on the upper Sacramento and Trinity rivers, as well as power production economics. A key consideration in the export timing determination is the thermal degradation that may occur in Lewiston Reservoir and Whiskeytown Lake due to the long residence time of transbasin exports in the lake.

[4] As described in Chapter 1, *Introduction*, Section 1.1, the full Draft EIR/EIS should be understood to include not only the EIR/EIS itself and its appendices but also the proposed BDCP documentation including all appendices.

Shasta Division and Sacramento River Division

The CVP's Shasta Division includes facilities that conserve water in the Sacramento River for (1) flood control, (2) navigation maintenance, (3) agricultural water supplies, (4) municipal and industrial (M&I) water supplies (5) hydroelectric power generation, (6) conservation of fish in the Sacramento River, and (7) protection of the Sacramento–San Joaquin Delta from intrusion of saline ocean water. The Shasta Division includes Shasta Dam, Lake, and Powerplant; Keswick Dam, Reservoir, and Powerplant, and the Shasta Temperature Control Device.

The Sacramento River Division was authorized after completion of the Shasta Division. Total authorized diversions for the Sacramento River Division (including Sacramento River Settlement and CVP Agricultural Water Service Contractors) are approximately 2.8 MAF. Historically the total diversion has varied from 1.8 MAF in a critically dry year to the full 2.8 MAF in a wet year. This division includes facilities for the diversion and conveyance of water to CVP contractors on the westside of the Sacramento River. The division includes the Sacramento Canals Unit, which was authorized in 1950 and consists of the Red Bluff Diversion Dam, the Corning Pumping Plant, and the Corning and Tehama-Colusa Canals. The unit was authorized to supply irrigation water to over 200,000 acres of land in the Sacramento Valley, principally in Tehama, Glenn, Colusa, and Yolo counties. Black Butte Dam, which is operated by the U.S. Army Corps of Engineers (USACE), also provides supplemental water to the Tehama-Colusa Canals as it crosses Stony Creek. The operations of the Shasta and Sacramento River divisions are presented together because of their operational interrelationships.

Shasta Dam is located on the Sacramento River just below the confluence of the Sacramento, McCloud, and Pit rivers. The dam regulates the flow from a drainage area of approximately 6,649 square miles. Shasta Dam was completed in 1945, forming Shasta Lake, which has a maximum storage capacity of 4,552,000 af. The mean annual inflow to Shasta Lake is about 5.7 MAF per year. Water in Shasta Lake is released through or around the Shasta Powerplant to the Sacramento River, where it is re-regulated downstream by Keswick Dam. A small amount of water is diverted directly from Shasta Lake for M&I uses by local communities.

Keswick Reservoir was formed by the completion of Keswick Dam in 1950. It has a capacity of approximately 23,800 af and serves as an afterbay for releases from Shasta Dam and for discharges from the Spring Creek Powerplant. All releases from Keswick Reservoir are made to the Sacramento River at Keswick Dam. The dam has a fish-trapping facility that operates in conjunction with the Coleman National Fish Hatchery on Battle Creek.

Flood control objectives for Shasta Lake require that releases be restricted to quantities that will not cause downstream flows or stages to exceed specified levels. These include a flow of 79,000 cubic feet per second (cfs) at the tailwater of Keswick Dam, and a stage of 39.2 feet in the Sacramento River at Bend Bridge gauging station, which corresponds to a flow of approximately 100,000 cfs. Flood control operations are based on regulating criteria developed by the USACE pursuant to the provisions of the Flood Control Act of 1944. Maximum flood space reservation is 1.3 MAF, with variable storage space requirements based on an inflow parameter.

Reclamation operates the Shasta, Sacramento River, and Trinity River divisions of the CVP to meet (to the extent possible) the provisions of State Water Board Order 90-05. An April 5, 1960, MOA between Reclamation and the California Department of Fish and Wildlife (CDFW, then Department of Fish and Game) originally established flow objectives in the Sacramento River for the protection and preservation of fish and wildlife resources. The agreement provided for minimum releases into the natural channel of the Sacramento River at Keswick Dam for normal and critically dry years. Since October 1981, Keswick Dam has operated based on a minimum release of 3,250 cfs for normal years from September 1 through the end of February, in accordance with an agreement between Reclamation and CDFW. This release schedule was included in Order 90-05, which maintains a minimum release of 3,250 cfs at Keswick Dam and Red Bluff Diversion Dam from September through the end of February in all water years, except critically dry years.

Historical commerce on the Sacramento River resulted in a CVP authorization to maintain minimum flows of 5,000 cfs at Chico Landing to support navigation. Currently, there is no commercial traffic between Sacramento and Chico Landing, and the USACE has not dredged this reach to preserve channel depths since 1972. However, long-time water users diverting from the river have set their pump intakes just below this level. Therefore, the CVP is operated to meet the navigation flow requirement of 5,000 cfs to Wilkins Slough (gauging station on the Sacramento River), under all but the most critical water supply conditions, to facilitate pumping and use of screened diversions. At flows below 5,000 cfs at Wilkins Slough, diverters have reported increased pump cavitation as well as greater pumping head requirements. Diverters are able to operate for extended periods at flows as low as 4,000 cfs at Wilkins Slough, but pumping operations become severely affected and some pumps become inoperable at flows lower than this. Flows may drop as low as 3,500 cfs for short periods while changes are made in Keswick releases to reach target levels at Wilkins Slough, but using the 3,500 cfs rate as a target level for an extended period would have major impacts on diverters.

Water temperature management in the upper Sacramento River is governed by Reclamation's water rights permit requirements and is consistent with BiOp requirements. Water temperature on the Sacramento River system is influenced by several factors, including the relative water temperatures and ratios of releases from Shasta Dam and from the Spring Creek Powerplant. The temperature of water released from Shasta Dam and the Spring Creek Powerplant is a function of the reservoir temperature profiles at the discharge points at Shasta and Whiskeytown, the depths from which releases are made, the seasonal management of the deep cold water reserves, ambient seasonal air temperatures and other climatic conditions, tributary accretions and water temperatures, and residence time in Keswick, Whiskeytown, and Lewiston Reservoirs and the Sacramento River.

In 1990 and 1991, the State Water Board issued Water Rights Orders 90-05 and 91-01 modifying Reclamation's water rights for the Sacramento River. The orders stated Reclamation shall operate Keswick and Shasta Dams and the Spring Creek Powerplant to meet a daily average water temperature of 56°F as far downstream in the Sacramento River as practicable during periods when higher temperature would be harmful to fisheries. The optimal control point is the Red Bluff Diversion Dam.

Construction of the Temperature Control Device (TCD) at Shasta Dam was completed in 1997. This device is designed for greater flexibility in managing the cold water reserves in Shasta Lake while enabling hydroelectric power generation to occur and to improve salmon habitat conditions in the upper Sacramento River. The TCD is also designed to enable selective release of water from varying lake levels through the power plant in order to manage and maintain adequate water temperatures in the Sacramento River downstream of Keswick Dam. Before construction of the Shasta TCD, Reclamation released water from Shasta Dam's low-level river outlets, thereby foregoing power generation, to alleviate high water temperatures during critical periods of the spawning and incubation life stages of the winter-run Chinook stock.

American River Division

Reclamation's Folsom Lake, the largest reservoir in the American River Watershed, has a capacity of 977,000 af. The mean annual inflow to Folsom Lake is about 2.7 MAF per year. Folsom Dam, located approximately 30 miles upstream from the confluence with the Sacramento River, is operated as a major component of the CVP. The American River Division includes facilities that provide conservation of water on the American River for flood control, fish and wildlife protection, recreation, protection of the Delta from intrusion of saline ocean water, irrigation and M&I water supplies, and hydroelectric power generation. Initially authorized features of the American River Division included Folsom Dam, Lake, and Powerplant; Nimbus Dam and Powerplant, and Lake Natoma.

Flood control requirements and regulating criteria are specified by the USACE and described in the *Folsom Dam and Lake, American River, California, Water Control Manual* (U.S. Army Corps of Engineers 1987). In February 1986, the American River Basin experienced a significant flood event. Folsom Dam and Reservoir moderated the flood event and performed the flood control objectives, but with serious operational strains and concerns in the Lower American River and the overall protection of the communities in the floodplain areas. A similar flood event occurred in January 1997.

Since then, significant review and enhancement of Lower American River flooding issues has occurred and continues to occur. A major element of those efforts has been the Sacramento Area Flood Control Agency (SAFCA) sponsored flood control plan diagram for Folsom Reservoir. Since 1996, Reclamation has operated according to modified flood control criteria, which reserve 400 to 670 thousand af of flood control space in Folsom and in a combination of three upstream reservoirs.

The minimum allowable flows in the Lower American River are defined by State Water Board Decision 893 (D-893) which states that, in the interest of fish conservation, releases should not ordinarily fall below 250 cfs between January 1 and September 15 or below 500 cfs at other times. D-893 minimum flows are rarely the controlling objective of CVP operations at Nimbus Dam. Nimbus Dam releases are nearly always controlled during significant portions of a water year by either flood control requirements or are coordinated with other SWP and CVP releases to meet downstream Sacramento–San Joaquin Delta Water Quality Control Plan (WQCP) requirements and CVP water supply objectives. Power regulation and management needs occasionally control Nimbus Dam releases. Nimbus Dam releases are expected to exceed the D-893 minimum flows in all but the driest of conditions.

In July 2006, Reclamation, the Sacramento Area Water Forum, other state and federal agencies, and other stakeholders completed a draft technical report proposing a flow regime intended to improve conditions for fish in the lower American River (i.e., the Lower American River Flow Management Standard [FMS]). Reclamation operates to this flow per the Reasonable and Prudent Alternative (RPA) presented in the NMFS 2009 BiOp. The modeling assumptions used for this analysis include the operational components of the recommended Lower American River flows consistent with the proposed FMS. Reclamation continues to work with the Sacramento Water Forum, USFWS, NMFS, CDFW, and other interested parties to integrate a revised flow management standard for the Lower American River into CVP operations and water rights. Flow augmentation for instream fishery purposes beyond that may occur pursuant to Section 3406 (b)(2) of the CVPIA on a case-by-case basis.

Water temperature control operations in the Lower American River are affected by many factors and operational tradeoffs. These include available cold water resources, Nimbus release schedules, annual hydrology, Folsom power penstock shutter management flexibility, and Nimbus Hatchery considerations. Shutter and TCD management provide the majority of operational flexibility used to control downstream temperatures.

Delta Division and West San Joaquin Division

The CVP's Delta Division includes the Delta Cross Channel, the Contra Costa Canal and Pumping Plants, Contra Loma Dam, Martinez Dam, the Jones Pumping Plant (formerly Tracy Pumping Plant), the Tracy Fish Collection Facility (TFCF), and the Delta Mendota Canal (DMC). The Delta Cross Channel is a controlled diversion channel between the Sacramento River and Snodgrass Slough. The Contra Costa Water District (CCWD) diversion facilities use CVP water resources to serve district customers directly and to operate CCWD's Los Vaqueros Project. The Jones Pumping Plant diverts water from the Delta to the head of the DMC.

The Delta Cross Channel is a gated diversion channel in the Sacramento River near Walnut Grove and Snodgrass Slough. Flows into the Delta Cross Channel from the Sacramento River are controlled by two 60-foot by 30-foot radial gates. When the gates are open, water flows from the Sacramento River through the cross channel to channels of the lower Mokelumne and San Joaquin Rivers toward the interior Delta. The Delta Cross Channel operation improves water quality in the interior Delta by improving circulation patterns of good quality water from the Sacramento River towards Delta diversion facilities.

Reclamation operates the Delta Cross Channel in the open position to (1) to provide a more direct flow route for water entering the Delta from the Sacramento River to the export facilities at the Banks and Jones Pumping Plants, (2) improve water quality in the southern Delta, and (3) reduce salt water intrusion rates in the western Delta. During the late fall, winter, and spring, the gates are often periodically closed to protect out-migrating salmonids from entering the interior Delta. In addition, whenever flows in the Sacramento River at Sacramento reach 20,000 to 25,000 cfs (on a sustained basis) the gates are closed to reduce potential scouring and flooding that might occur in the channels on the downstream side of the gates.

State Water Board Decision 1641 requires the closure of the Delta Cross Channel gates for fisheries protection at certain times of the year. Under D-1641, from June 16 through October 31, gates will generally be open. High flows on the Sacramento River, unforeseen fishery protection actions, or water quality compliance in the Delta may necessitate a short-term closure. From November 1 through January 31, the Delta Cross Channel may be closed for up to 45 days for fishery protection purposes. From February 1 through May 20, the gates are closed for fishery protection purposes. The gates may also be closed for a total of 14 days for fishery protection purposes during the May 21 through June 15 time period. Reclamation determines the timing and duration of the closures after discussion with USFWS, CDFW, and NMFS. 2009 NMFS BiOp requires additional closure in fall and early winter months. The 2009 NMFS BiOp requires that the gates are closed October 1 through November 30 if there is fish presence, and from December 1 through January 31 except for days that the D-1641 water quality criteria cannot be met without opening the gates or for experimental purposes during the December 1 - December 14 period.

The CVP uses the Sacramento River, San Joaquin River, and Delta channels to transport water to the export pumping plant located in the south Delta. The CVP's Jones Pumping Plant, about five miles north of Tracy, consists of six available pumps. The Jones Pumping Plant is located at the end of an earth-lined intake channel about 2.5 miles in length. At the head of the intake channel, louver screens intercept fish, which are then collected, held, and transported by tanker truck to release sites far away from the pumping plants. Jones Pumping Plant has a permitted diversion capacity of 4,600 cfs with maximum pumping rates typically ranging from 4,500 to 4,300 cfs during the peak of the irrigation season and approximately 4,200 cfs during the winter non-irrigation season until construction and full operation of the proposed DMC/California Aqueduct Intertie. The winter-time constraints at the Jones Pumping Plant are the result of a DMC freeboard constriction between Jones Pumping Plant and O'Neill Forebay, O'Neill Pumping Plant capacity, and the current water demand in the upper sections of the DMC.

Water Demands—Delta Mendota Canal and San Luis Unit

The DMC was completed in 1951 and is operated and maintained by the San Luis and Delta-Mendota Water Authority under contract with Reclamation. The DMC begins at the Jones Pumping Plant and runs 117 miles south along the western edge of the San Joaquin Valley. Water may be pumped from the canal into O'Neill Forebay, and then pumped into San Luis Reservoir by the Gianelli Pumping-Generating Plant. The DMC ends at Mendota Pool, on the San Joaquin River near the town of Mendota. The DMC has an initial capacity of 4,600 cfs that decreases to about 3,200 cfs at its terminus.

Water demands for the DMC and San Luis Unit are primarily composed of three separate types: CVP water service contractors, exchange contractors, and wildlife refuge contractors. A considerably different relationship exists between Reclamation and contractors within each of these three groups. Exchange contractors agreed not to exercise their senior rights to water in the San Joaquin River for a CVP water supply from the Delta. Reclamation thus provided the exchange contractors a firm CVP water supply of 840,000 af per annum, with a maximum reduction under the Shasta critical year criteria to an annual water supply of 650,000 af. Conversely, water service contractors do not have water rights. Some CVP water service contractors also receive their CVP water supply from the Delta, but their water supplies are subject to the availability of CVP water supplies that can be developed and reductions in contractual supply can occur. Wildlife refuge contractors receive CVP water supplies for specific managed lands for wildlife purposes and the CVP contract water supply can be reduced under critically dry conditions up to 25%.

To achieve the best operation of the CVP, it is necessary to combine the contractual demands of these three types of contractors to achieve an overall pattern of requests for water. In most years sufficient supplies are not available to meet all water contractor demands because of statutory, regulatory and water rights requirements. In some dry or critically dry years, water deliveries are limited because there is insufficient storage in northern CVP reservoirs to meet all statutory, regulatory and water rights requirements including water temperatures, and to make additional water deliveries via the Jones Pumping Plant. The scheduling of water demands, together with the scheduling of the releases of water supplies from the northern CVP reservoirs and CVP San Luis Reservoir to meet those demands, is a CVP operational objective that is intertwined with the Trinity, Sacramento, and American River operations.

East Side Division

The Stanislaus River originates in the western slopes of the Sierra Nevada and drains a watershed of approximately 900 square miles. The average unimpaired runoff in the basin is approximately 1.2 MAF per year; the median historical unimpaired runoff is 1.1 MAF per year. Snowmelt contributes the largest portion of the flows in the Stanislaus River, with the highest runoff occurring in the months of April, May, and June. The flow in the lower Stanislaus River is primarily controlled by New Melones Reservoir, which has a storage capacity of about 2.4 MAF. The reservoir was completed by the USACE in 1978 and approved for filling in 1983. New Melones Reservoir is located approximately 60 miles upstream from the confluence of the Stanislaus River and the San Joaquin River and is operated by Reclamation. Congressional authorization for New Melones integrates New Melones Reservoir as a financial component of the CVP, but it is authorized to provide water supply benefits within the defined Stanislaus Basin per the 1980 ROD before additional water supplies can be used out of the defined Stanislaus Basin.

New Melones Reservoir is operated primarily for purposes of water supply, flood control, power generation, fishery enhancement, and water quality improvement in the lower San Joaquin River. The reservoir and river also provide recreation benefits. Flood control operations are conducted in conformance with the USACE's operational guidelines.

The New Melones Reservoir flood control operation is coordinated with the operation of Tulloch Reservoir. The flood control objective is to maintain flood flows at the Orange Blossom Bridge at less than 8,000 cfs. Up to 450,000 af of the 2.4 MAF storage volume in New Melones Reservoir is dedicated for flood control and 10,000 af of Tulloch Reservoir storage is set aside for flood control. Based upon the flood control diagrams prepared by the USACE, part or all of the dedicated flood control storage may be used for conservation storage, depending on the time of year and the current flood hazard.

The operating criteria for New Melones Reservoir are affected by (1) water rights, (2) in-stream fish and wildlife flow requirements (3) applicable State Water Board Decision 1641 water quality and flow requirements, (4) dissolved oxygen (DO) requirements on the Stanislaus River, (5) CVP contracts, and (6) flood control considerations. Water released from New Melones Dam and Powerplant is re-regulated at Tulloch Reservoir and is either diverted at Goodwin Dam primarily for irrigation purposes, or released from Goodwin Dam to the lower Stanislaus River. Flows in the lower Stanislaus River serve multiple purposes concurrently. The purposes include water supply for riparian water right holders, fishery management objectives, and DO requirements per State Water Board D-1422. In addition, water from the Stanislaus River enters the San Joaquin River where it contributes to flow and helps improve water quality conditions at Vernalis. D-1422, issued in 1973, provided the primary operational criteria for New Melones Reservoir and permitted Reclamation to appropriate water from the Stanislaus River for irrigation and M&I uses. D-1422 requires the operation of New Melones Reservoir include releases for existing water rights, fish and wildlife enhancement, and the maintenance of water quality conditions on the Stanislaus and San Joaquin Rivers.

State Water Board Decision 1641 sets flow requirements on the San Joaquin River at Vernalis from February to June. These flows are commonly known as the Vernalis Bay-Delta flow requirements. Since Decision 1641 has been in place, the Vernalis Bay-Delta flow requirements have at times, been an additional demand on the New Melones water supply beyond that provided for in the Interim Plan of Operation (IPO).

Adopted by the State Water Board in Decision-1641, the Vernalis Adaptive Management Plan (VAMP) included a 12-year program providing for flows and exports in the lower San Joaquin River during a 31-day pulse flow period during April and May. The San Joaquin River Agreement (SJRA), adopted through Decision-1641, that provided flows in the lower San Joaquin River during pulse flow periods expired at the end of 2011. VAMP provided for the collection of experimental data during that time to further the understanding of the effects of flows, exports, and the barrier at the head of Old River on salmon survival. VAMP has two distinct components, a flow objective and an export restriction. The flow objectives were designed to provide similar protection to those defined in the WQCP. Water releases for fisheries on the Stanislaus River that are more than what is called for in the 1987 CDFW Agreement are typically considered CVPIA Section 3406(b)(2) or Section 3406(b)(3) releases for AFRP objectives and/or NMFS 2009 BiOp RPA requirements. The export reduction involves a combined state and federal pumping limitation on the Delta pumps.

The 2009 NMFS BiOp Action III.1.3 requires Reclamation to make releases from the East Side Division reservoirs to achieve minimum flows below Goodwin Dam. The flow schedule specifies minimum flows and does not preclude Reclamation from making higher releases for other operational criteria. When operating at higher flows than specified, Reclamation shall implement ramping rates for flow changes that will avoid stranding and other adverse effects on CV steelhead. In particular, flows that exceed 800 cfs will inundate known side channels that provide habitat, but that also pose stranding risks.

Water temperatures in the lower Stanislaus River are affected by many factors and operational tradeoffs. These include available cold water resources in New Melones reservoir, Goodwin release rates for fishery flow management and water quality objectives, as well as residence time in Tulloch Reservoir, as affected by local irrigation demand. Reclamation intends to plan and manage flows to meet a 65°F water temperature objective at Orange Blossom Bridge for steelhead incubation and rearing during the late spring and summer. However, during critically dry years and low reservoir storages this objective cannot be met. USFWS, in coordination with NMFS and CDFW, identifies the schedule for Reclamation to provide fall pulse attraction flows for salmon. The pulse flows are a combination of water purchased under the San Joaquin River Agreement and CVPIA (b)(2) and (b)(3) water. This movement of water also helps to transport cold water from New Melones Reservoir into Tulloch Reservoir before the spawning season begins.

San Felipe Division

Construction of the San Felipe Division of the CVP was authorized in 1967. The San Felipe Division provides a supplemental water supply (for irrigation, M&I uses) in the Santa Clara Valley in Santa Clara County, and the north portion of San Benito County. The San Felipe Division delivers both irrigation and M&I water supplies. Water is delivered within the service areas not only by direct diversion from distribution systems, but also through in-stream and off-stream groundwater recharge operations being carried out by local interests. A primary purpose of the San Felipe Division in Santa Clara County is to provide supplemental water to help prevent land surface subsidence in the Santa Clara Valley caused by groundwater pumping. The majority of the water supplied to Santa Clara County is used for M&I purposes, either pumped from the groundwater basin or delivered from treatment plants. In San Benito County, a distribution system was constructed to provide supplemental water to about 19,700 arable acres. The facilities required to serve Santa Clara and San Benito Counties include 54 miles of tunnels and conduits, two large pumping plants, and one reservoir. Water is conveyed from the Delta of the San Joaquin and Sacramento Rivers through the DMC. It is then pumped into the San Luis Reservoir and diverted through the 1.8-mile long of Pacheco Tunnel inlet to the Pacheco Pumping Plant. Twelve 2,000-horse-power pumps lift a maximum of 490 cfs a height varying from 85 feet to 300 feet to the 5.3-mile-long Pacheco Tunnel. The water then flows through the tunnel and without additional pumping, through 29 miles of concrete, high-pressure pipeline, varying in diameter from 10 feet to 8 feet, and the mile-long Santa Clara Tunnel. In Santa Clara County, the pipeline terminates at the Coyote Pumping Plant, which is capable of pumping water to into Anderson Reservoir or Calero Reservoir for further distribution at treatment plants or groundwater recharge.

Santa Clara Valley Water District is the nonfederal operating entity for all the San Felipe Division facilities except for the Hollister Conduit and San Justo Reservoir. The San Benito County Water District operates San Justo Reservoir and the Hollister Conduit. The Hollister Conduit branches off the Pacheco Conduit 8 miles from the outlet of the Pacheco Tunnel. This 19.1-mile-long high-pressure pipeline, with a maximum capacity of 83 cfs, terminates at the San Justo Reservoir.

Friant Division

Friant Dam is located on the San Joaquin River, 25 miles northeast of Fresno where the San Joaquin River exits the Sierra foothills and enters the valley. The drainage basin is 1,676 square miles with an average annual runoff of 1,774,000 af. Completed in 1942, the dam is a concrete gravity structure, 319-feet high, with a crest length of 3,488 feet. Although the dam was completed in 1942, it was not placed into full operation until 1951.

The dam provides flood control on the San Joaquin River, provides downstream releases to meet senior water rights requirements above Mendota Pool, and provides conservation storage as well as diversion into Madera and Friant-Kern Canals. Water is delivered to a million acres of agricultural land in Fresno, Kern, Madera, and Tulare Counties in the San Joaquin Valley via the Friant-Kern Canal south into Tulare Lake Basin and via the Madera Canal northerly to Madera and Chowchilla IDs. A minimum of 5 cfs is required to pass the last water right holding located about 40 miles downstream near Gravelly Ford.

The reservoir, Millerton Lake, first stored water on February 21, 1944. It has a total capacity of 520,528 af, a surface area of 4,900 acres, and is approximately 15-miles long. The lake's 45 miles of shoreline varies from gentle slopes near the dam to steep canyon walls farther inland. The reservoir provides boating, fishing, picnicking, and swimming.

Flood control storage space in Millerton Lake is based on a complex formula, which considers upstream storage in the Southern California Edison reservoirs. Under flood conditions, water is diverted into two bypass channels that carry flood flows to the confluence of the Merced River. (U.S. Bureau of Reclamation 2008a).

5.1.2.2 SWP Facilities

DWR holds contracts with 29 public agencies in Northern, Central and Southern California for water supplies from the SWP. Water stored in the Oroville facilities and diverted through the Delta, along with available water in the Delta, is conveyed through several facilities to SWP contractors. The SWP is operated to provide flood control and water for agricultural, municipal, industrial, recreational, and environmental purposes. Water is conserved in Oroville Reservoir and released to serve three Feather River area contractors and two contractors served from the North Bay Aqueduct, and to be pumped at the Harvey O. Banks Pumping Plant (Banks) in the Delta and delivered to the remaining 24 contractors in the SWP service areas south of the Delta. See Figure 1-3 for a map of the SWP service areas. In addition to pumping water released from Oroville Reservoir, Banks Pumping Plant pumps water from other sources entering the Delta. The SWP is managed to maximize the capture of water in the Delta and the usable supply released to the Delta from Oroville storage. The maximum daily pumping rate at Banks is controlled by a combination of the Decision 1641, the adaptive management, and permits issued by the USACE that regulate the rate of diversion of water into Clifton Court Forebay for pumping at Banks.

During parts of April and May, the VAMP takes effect as described in the CVP section above. The state and federal pumps reduce their export pumping to benefit fish in the San Joaquin River system. Around this same time, water demands from both agricultural and M&I contractors are increasing, Article 21[5] water is usually discontinued, and San Luis supplies are released to the SWP facilities to supplement Delta pumping at Banks, thereby meeting contractor demands. The SWP intends to continue VAMP type export reductions through 2030. By late May, demands usually exceed the restored pumping rate at Banks, and continued releases from San Luis Reservoir are needed to meet contractor demands for Table A water[6]. USACE and SWRCB can approve an additional 500 cfs diversion during summer months to make up for lost April-May diversions during VAMP.

In addition to the requirements established by State Water Board and other federal and state agencies, SWP operations are subject to requirements of their contracts.

Oroville Field Division

Oroville Dam and related facilities comprise a multipurpose project. The reservoir stores winter and spring runoff, which is later released from storage into the Feather River to meet SWP demands and the project needs. It also provides pumpback capability to allow for on-peak electrical generation, 750,000 af of flood control storage, recreation, and freshwater releases to control salinity intrusion in the Delta and for fish and wildlife protection. The location of the Oroville facilities is shown in Figure 1-2. Lake Oroville has a storage capacity of approximately 3.5 MAF, and is fed by the North, Middle, and South forks of the Feather River. Average annual unimpaired runoff into the lake is about 4.5 MAF.

Approximately 4 miles downstream of Oroville Dam and Edward Hyatt Powerplant is the Thermalito Diversion Dam. Thermalito Diversion Dam consists of a 625-foot-long, concrete gravity section with a regulated ogee spillway that releases water to the low flow channel of the Feather River. On the right abutment is the Thermalito Power Canal regulating headwork structure. The purpose of the diversion dam is to divert water into the 2-mile long Thermalito Power Canal that conveys water in either direction and creates a tailwater pool (called Thermalito Diversion Pool) for Edward Hyatt Powerplant. The Thermalito Diversion Pool acts as a forebay when Hyatt is pumping water back into Lake Oroville. On the left abutment is the Thermalito Diversion Dam Powerplant with a capacity of 600 cfs, which releases water to the low-flow section of the Feather River.

Local agricultural districts divert water directly from the afterbay. These diversion points are in lieu of the traditional river diversion exercised by the local districts whose water rights are senior to the SWP.

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[5] Article 21 provides for sales of surplus water available (water not needed for project purposes) in the SWP system during times of heavy flow and could be sold for the cost of transporting it to the buyer typically in the months between November and April.

[6] Table A is an exhibit to the SWP's water supply contracts. This section explains Table A water and outlines the primary factors that influence the amount of such water actually delivered to SWP contractors. The water supply–related costs of the SWP are paid for by SWP contractors. All water contracts signed in the 1960s included an estimate of the date that SWP water would first be delivered and a schedule of the amount of water the contractor could expect to be delivered annually. That amount of water, known as the contractor's annual Table A amount, was designed to increase gradually until the designated maximum for that SWP contractor was reached.

The release temperatures from Oroville Dam are designed to meet Feather River Fish Hatchery and Robinson Riffle temperature schedules included in the 1983 CDFW Agreement[7] concerning the operations of the Oroville Division of the SWP for Management of Fish and Wildlife and 2008 and 2009 USFWS and NMFS BiOps while also conserving the coldwater pool in Lake Oroville. Additionally, DWR maintains a minimum flow of 600 cfs within the Feather River Low Flow Channel (LFC) except during flood events when flows are governed by the Flood Operations Manual.

Current operations of the Oroville Facilities are governed, in part, by water temperature requirements at two locations: the Feather River Fish Hatchery and in the Low Flow Channel at Robinson Riffle. DWR has taken various temperature management actions to achieve the water temperature requirements, including curtailing pumpback operations, removing shutters at intakes of the Hyatt Pumping-Generating Plant, releasing flow through the river valves (for the hatchery only), and redirecting flows at the Thermalito Diversion Dam to the Low Flow Channel (for Robinson Riffle only).The existing Feather River flow requirements below Oroville Dam are based on an August 1983 Agreement between the DWR and CDFW (then DFG). The 1983 Agreement established criteria and objectives for flow and temperatures in the Low Flow Channel, Feather River Fish Hatchery, and the High Flow Channel.

Flood control operations at Oroville Dam are conducted in coordination with DWR's Flood Operations Center and in accordance with the requirements set forth by the USACE. The federal Government shared the expense of Oroville Dam, which provides up to 750,000 af of flood control space. The spillway is located on the right abutment of the dam and has two separate elements: a controlled gated outlet and an emergency uncontrolled spillway. The gated control structure releases water to a concrete-lined chute that extends to the river. The uncontrolled emergency spill flows over natural terrain.

Until Federal Energy Regulatory Commission (FERC) issues the new license for the Oroville Project, (as discussed more fully in Section 5.2.1.3 below), DWR will not substantially change the operations of the facilities. When the FERC license is issued, it is assumed that downstream of Thermalito Afterbay Outlet, the future flows will remain the same.

Delta Field Division

SWP facilities in the southern Delta include Clifton Court Forebay, John E. Skinner Fish Protective Facility, and the Banks Pumping Plant.

Clifton Court Forebay is a 31,000 acre-foot reservoir located in the southwestern edge of the Delta, about 10 miles northwest of Tracy. Clifton Court Forebay provides storage for off-peak pumping, moderates the effect of the pumps on the fluctuation of flow and stage in adjacent Delta channels, and collects sediment before it enters the California Aqueduct. Diversions from Old River into Clifton Court Forebay are regulated by five radial gates.

The Skinner Fish Facility is located west of the Clifton Court Forebay, 2 miles upstream of the Banks Pumping Plant. The Skinner Fish Facility screens fish away from the pumps that lift water into the California Aqueduct. Large fish and debris are prevented from entering the facility by a 388-foot long trash boom. Smaller fish are diverted from the intake channel into bypasses by a series of metal

[7] Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish and Wildlife.

louvers, while the main flow of water continues through the louvers and towards the pumps. These fish pass through a secondary system of screens and pipes into seven holding tanks, where a subsample is counted and recorded. The salvaged fish are then returned to the Delta in oxygenated tank trucks. Very small fish typically remain in the main flow of water, and are transported to the pumps and exported from the Delta

The Banks Pumping Plant is in the south Delta, about 8 miles northwest of Tracy, and marks the beginning of the California Aqueduct. By means of 11 pumps, including two rated at 375 cfs capacity, five at 1,130 cfs capacity, and four at 1,067 cfs capacity, the plant provides the initial lift of water 244 feet into the California Aqueduct. The nominal capacity of the Banks Pumping Plant is 10,300 cfs. Other SWP-operated facilities in and near the Delta include the North Bay Aqueduct, the Suisun Marsh Salinity Control Gates, Roaring River Distribution System, and up to four temporary barriers in the south Delta. Each of these facilities is discussed further in later sections.

California Aqueduct

Banks Pumping Plant lifts water into the California Aqueduct, which then flows to Bethany Reservoir. From Bethany Reservoir, the South Bay Pumping Plant lifts water into the South Bay Aqueduct to supply portions of Alameda and Santa Clara counties. The South Bay Aqueduct provided initial deliveries in 1962 and has been fully operational since 1965. South Bay Aqueduct facilities include Lake Del Valle and Patterson Reservoir. For further description of these facilities, see Appendix 1A, *Primer on the Delta and California Water Delivery Systems.*

From Bethany Reservoir, the 444-mile-long California Aqueduct conveys water to the primarily agricultural lands of the San Joaquin Valley and the mainly urban regions of Southern California. The first SWP deliveries to San Joaquin Valley contractors began in 1968. The first SWP deliveries to southern California began in 1972.

The California Aqueduct winds along the west side of the San Joaquin Valley. It transports water to O'Neill Forebay. Water in the Forebay can be released to the San Luis Canal or pumped into San Luis Reservoir by the Gianelli Pumping Plant. San Luis Reservoir has a storage capacity of more than 2 MAF and is a joint facility of the DWR and Reclamation. The SWP's share of the reservoir's gross storage is about 1,062,180 af. DWR generally pumps water through the Gianelli Pumping-Generating Plant into San Luis Reservoir during late fall through early spring for temporary storage until water is released to meet late-spring and summer peaking demands of SWP contractors.

SWP water pumped directly from the Delta and water eventually released from San Luis Reservoir continues to flow south in the San Luis Canal, a portion of the California Aqueduct jointly used by the SWP and CVP. The joint use ends near Kettleman City, and the SWP portion of the California Aqueduct continues. As the water flows through the San Joaquin Valley, numerous turnouts convey the water to farmlands within the service areas of the SWP and CVP. Along its journey, four pumping plants—Dos Amigos, Buena Vista, Teerink, and Chrisman—lift the water more than 1,000 feet before it reaches the foot of the Tehachapi Mountains.

In the San Joaquin Valley near Kettleman City, Phase I of the Coastal Branch Aqueduct serves agricultural areas west of the California Aqueduct. The Coastal Branch's Phase II extended the conveyance facility to serve M&I water users in San Luis Obispo and Santa Barbara counties. Phase II became operational in 1997.

The remaining water conveyed by the California Aqueduct is delivered to Southern California, home to about one-half of California's total population. Before this water can be delivered, the water must first cross the Tehachapi Mountains. Pumps at Edmonston Pumping Plant, situated at the foot of the mountains, raise the water 1,926 feet—the highest single lift of any pumping plant in the world. From there, the water enters about 8 miles of tunnels and siphons as it flows into Antelope Valley, where the California Aqueduct divides into two branches; the East Branch and the West Branch.

The East Branch carries water through the Tehachapi East Afterbay, Alamo Powerplant, Pearblossom Pumping Plant, and Mojave Siphon Powerplant into Silverwood Lake in the San Bernardino Mountains, which stores 73,000 af. From Silverwood Lake, water flows through the San Bernardino Tunnel into Devil Canyon Powerplant. Water continues down the East Branch to Lake Perris, the terminus of the East Branch. Lake Perris lies just east of Riverside, has a capacity of 131,500 af, and serves as a regulatory and emergency water supply facility for the East Branch.

Phase I of the East Branch Extension of the California Aqueduct was completed in 2003 and provides conveyance facilities to deliver SWP water to San Gorgonio Pass Water Agency, and to the eastern portion of the San Bernardino Valley Municipal Water District, which will deliver water to areas such as Yucaipa, Calimesa, Beaumont, Banning, and other communities. The East Branch Extension is comprised of a combination of existing San Bernardino Valley Municipal Water District facilities and newly constructed SWP facilities. While the new pipelines were designed for the ultimate conveyance capacity, the installed Phase I pumping capacity is less than one-half the ultimate capacity—enough to meet the immediate foreseeable demand for SWP water. Phase II will bring the extension to its ultimate storage and conveyance capacity with new pipelines, pumping, and storage facilities. Currently, the DWR is in the planning stages of Phase II. A feasibility study and a Phase II Project Environmental Impact Report are being concurrently developed.

At the bifurcation of the California Aqueduct in Antelope Valley, the West Branch carries water through Oso Pumping Plant, Quail Lake, Lower Quail Canal, and William E. Warne Powerplant into Pyramid Lake in Los Angeles County. From there, water flows through the Angeles Tunnel, Castaic Powerplant, Elderberry Forebay, and Castaic Lake, terminus of the West Branch. Castaic Lake is located north of Santa Clarita, has a capacity of 324,000 af, and is a regulatory and emergency water supply facility for the West Branch. Castaic Powerplant is owned and operated by the Los Angeles Department of Water and Power.

North Bay Aqueduct and Barker Slough Pumping Plant

The Barker Slough Pumping Plant diverts water from Barker Slough into the North Bay Aqueduct for delivery in Napa and Solano Counties. Maximum pumping capacity is 175 cfs (pipeline capacity). During the past few years, daily pumping rates have ranged between 0 cfs and 140 cfs. The current maximum pumping rate is 140 cfs because an additional pump is required to be installed to reach 175 cfs. In addition, growth of biofilm in a portion of the pipeline is also limiting the North Bay Aqueduct's ability to reach its full capacity.

The North Bay Aqueduct intake is located approximately 10 miles from the main stem Sacramento River at the end of Barker Slough. Per salmon screening criteria, each of the ten North Bay Aqueduct pump bays is individually screened with a positive barrier fish screen consisting of a series of flat, stainless steel, wedge-wire panels with a slot width of 3/32 inch. This configuration is designed to exclude fish approximately one inch or larger from being entrained.

5.1.2.3 SWP/CVP Coordinated Facilities and Operations

The SWP and CVP use a common water supply in the Central Valley of California. DWR and Reclamation coordinate operations of water delivery facilities in the Central Valley in order to deliver water supplies to affected water rights holders as well as project contractors. The water rights for the CVP and SWP are conditioned by the State Water Board to protect the beneficial uses of water within each respective project and for the combined protection of beneficial uses in the Sacramento Valley and the Sacramento–San Joaquin Delta Estuary. The SWP and CVP coordinate and operate to meet the common water right requirements in the Delta.

The Coordinated Operations Agreement (COA), signed in 1986, sets forth procedures for coordination of operations, identifies formulas for sharing joint responsibilities for meeting Delta standards, as the standards existed in State Water Board Decision 1485, and other legal uses of water, identifies how unstored flow will be shared, sets up a framework for exchange of water and services between the projects, and provides for periodic review of the agreement. COA has not been formally updated to address more recent changes in regulatory environment, but the projects continue to coordinate to account for new requirements.

Because of the SWP large pumping capacity and relatively limited upstream storage and the CVP's large upstream storage and relatively limited pumping capacity, SWP exports are typically greater than CVP exports during excess flow conditions.

Suisun Marsh

Since the early 1970s, the California Legislature, State Water Board, Reclamation, CDFW, Suisun Resource Conservation District (SRCD), DWR, and other agencies have worked to preserve beneficial uses of Suisun Marsh. Early on, salinity standards were set by the State Water Board to protect alkali bulrush production, a primary waterfowl plant food. The most recent standard under Decision 1641 acknowledges that multiple beneficial uses deserve protection.

A contractual agreement between DWR, Reclamation, CDFW, and SRCD contains provisions for DWR and Reclamation to mitigate the effects on Suisun Marsh channel water salinity from the SWP and CVP operations and other upstream diversions. The Suisun Marsh Preservation Agreement (SMPA) requires DWR and Reclamation to meet salinity standards, sets a timeline for implementing the Plan of Protection, and delineates monitoring and mitigation requirements. In addition to the contractual agreement, State Water Board Water Rights Decision 1485 adopted salinity standards in 1978, which have been carried forward to State Water Board Water Rights Decision 1641.

There are two primary physical mechanisms for meeting salinity standards set forth in Decision 1641 and the SMPA: (1) the implementation and operation of physical facilities in the Marsh and (2) management of Delta outflow (i.e., facility operations are driven largely by salinity levels upstream of Montezuma Slough and salinity levels are highly sensitive to Delta outflow). Physical facilities (described below) have been operating since the early 1980s and have proven to be a highly reliable method for meeting standards.

Suisun Marsh Salinity Control Gates

The Suisun Marsh Salinity Control Gates are located on Montezuma Slough about 2 miles downstream from the confluence of the Sacramento and San Joaquin Rivers, near Collinsville. Operation of the gates began in October 1988 as Phase II of the Plan of Protection for the Suisun

Marsh. The objective of gate operation is to decrease the salinity of the water in Montezuma Slough. The facility, spanning the 250 to 350-foot width of Montezuma Slough, consists of a boat lock, a series of three radial gates, and removable flashboards. The gates control salinity by restricting the flow of higher-salinity water from Grizzly Bay into Montezuma Slough during incoming tides, and by retaining lower-salinity Sacramento River water from the previous ebb tide. Operation of the gates in this fashion lowers salinity in Suisun Marsh channels and results in a net movement of water from east to west.

Roaring River Distribution System

The Roaring River Distribution System was constructed during 1979 and 1980 as part of the Initial Facilities in the Plan of Protection for the Suisun Marsh. The system was constructed to provide lower-salinity water to 5,000 acres of private and 3,000 acres of CDFW-managed wetlands on Simmons, Hammond, Van Sickle, Wheeler, and Grizzly Islands. The distribution system includes a 40-acre intake pond that supplies water to Roaring River Slough. Motorized slide gates in Montezuma Slough and flap gates in the pond control flows through the culverts into the pond. A manually operated flap gate and flashboard riser are located at the confluence of Roaring River and Montezuma Slough to allow drainage back into Montezuma Slough for controlling water levels in the distribution system and for flood protection. DWR owns and operates this drain gate to ensure that Roaring River levees are not compromised during extremely high tides.

Water is diverted through a bank of eight 60-inch-diameter culverts equipped with fish screens into the Roaring River intake pond on high tides to raise the water surface elevation in distribution system above the adjacent managed wetlands. Managed wetlands north and south of the system receive water, as needed, through publicly and privately owned turnouts on the system. The intake to the distribution system is screened to prevent entrainment of fish larger than approximately 25 mm.

Morrow Island Distribution System

The Morrow Island Distribution System was constructed in 1979 and 1980 in the southwestern Suisun Marsh as part of the Initial Facilities in the Plan of Protection for the Suisun Marsh. The contractual requirement for the Reclamation and DWR is to provide water to the ownerships so that lands may be managed according to approved local management plans. The system was constructed primarily to channel drainage water from the adjacent managed wetlands for discharge into Suisun Slough and Grizzly Bay. This approach increases circulation and reduces salinity in Goodyear Slough.

The distribution system is used year-round, but most intensively from September through June. When managed wetlands are filling and circulating, water is tidally diverted from Goodyear Slough just south of Pierce Harbor through three 48-inch culverts. Drainage water from Morrow Island is discharged into Grizzly Bay by way of the C-Line Outfall (two 36-inch culverts) and into the mouth of Suisun Slough by way of the M-Line Outfall (three 48-inch culverts), rather than back into Goodyear Slough. This helps prevent increases in salinity due to drainage water discharges into Goodyear Slough. The M-Line ditch is approximately 1.6 miles in length and the C-Line ditch is approximately 0.8 miles in length.

South Delta Temporary Barriers Project

The South Delta Temporary Barrier Project was initiated by DWR in 1991. Permit extensions were granted in 1996 and again in 2001, when DWR obtained permits to extend the Temporary Barriers

Project through 2007. The USFWS approved the extension of the permits through 2008. This project was included in the Project Description analyzed in the USFWS 2008 BiOp and NMFS 2009 BiOp for the Coordinated Long-term Operation of the CVP and SWP for the operational effects and under a separate Section 7 consultation for the construction and demolition effects.

The project consists of four rock barriers across south Delta channels. In various combinations, these barriers improve water levels and help direct migrating San Joaquin River salmon away from entering the south Delta at the Old River intersection. The existing project consists of installation and removal of temporary rock barriers at the following locations.

- Middle River near Victoria Canal, about 0.5 mile south of the confluence of Middle River, Trapper Slough, and North Canal.
- Old River near Tracy, about 0.5 mile east of the Delta-Mendota Canal intake.
- Grant Line Canal near Tracy Boulevard Bridge, about 400 feet east of Tracy Boulevard.
- The head of Old River at the confluence of Old River and San Joaquin River.

The barriers on Middle River, Old River near Tracy, and Grant Line Canal are flow control facilities designed to improve water levels for agricultural diversions and are in place during the growing season. Under the USFWS BiOp for the Temporary Barriers, annual operation of the barriers at Middle River and Old River near Tracy can begin May 15, or as early as April 15 if the spring barrier at the head of Old River is in place. From May 16 to May 31 (if the barrier at the head of Old River is removed) the tide gates are tied open in the barriers in Middle River and Old River near Tracy. After May 31, the barriers in Middle River, Old River near Tracy, and Grant Line Canal are permitted to be operational until they are completely removed by November 30.

During the spring, the barrier at the head of Old River is designed to reduce the number of outmigrating salmon smolts entering Old River. During the fall, this barrier is designed to improve flow and dissolved oxygen conditions in the San Joaquin River for the immigration of adult fall-run Chinook salmon. The barrier at the head of Old River barrier is typically in place between April 15 to May 15 for the spring, and between early September to late November for the fall. Installation and operation of the barrier also depends on San Joaquin flow conditions.

In 2009 and again in 2010, a nonphysical barrier was installed. This experimental barrier, which was placed near the channel bottom and extended across the entrance to Old River, used a combination of bubbles, lights, and sound to guide outmigrating Chinook salmon smolts down the San Joaquin River and away from the Old River. Underwater receivers were installed to monitor the number of tagged smolts that moved through the experimental barrier (if any) when in operation during the April 15 through May 15 period, or through June 15 when requested by NMFS.

5.1.2.4 San Luis Complex

Water in the mainstem of the California Aqueduct flows south by gravity into the San Luis Joint-Use Complex, which was designed and constructed by the federal government and is operated and maintained by the DWR. This section of the California Aqueduct serves both the SWP and the CVP. San Luis Reservoir, the nation’s largest offstream reservoir, is impounded by Sisk Dam and lies at the base of the foothills on the west side of the San Joaquin Valley in Merced County, about 2 miles west of O’Neill Forebay. The reservoir provides offstream storage for excess winter and spring flows diverted from the Delta. It is sized to provide seasonal carryover storage. The reservoir can hold 2,027,840 af, of which 1,062,180 af (approximately 52%) is DWR’s share, and 965,660 af (approximately 48%) is Reclamation's share. Construction began in 1963 and was completed in 1967. Filled in 1969, the reservoir also provides a variety of recreational activities as well as fish and wildlife benefits.

In addition to the Sisk Dam, San Luis Reservoir, and O'Neill Dam and Forebay, the San Luis Complex consists of the following.

- O'Neill Pumping-Generating Plant (federal facility).
- William R. Gianelli Pumping-Generating Plant (joint federal–state facilities).
- San Luis Canal (joint federal–state facilities).
- Dos Amigos Pumping Plant (joint federal–state facilities).
- Coalinga Canal (federal facility).
- Pleasant Valley Pumping Plant (federal facility).
- Los Banos and Little Panoche Detention Dams and Reservoirs (joint federal–state facilities).

The O'Neill Pumping-Generating Plant pumps water from the Delta-Mendota Canal to the O'Neill Forebay, where it mixes with water from the California Aqueduct. From O'Neill Forebay, the water can either be pumped up into San Luis Reservoir via Gianelli Pumping-Generating Plant or leave via the San Luis Canal. The Dos Amigos Pumping Plant is located on the San Luis Canal and 18 miles southeast of Sisk Dam. It lifts water 113 feet from the aqueduct as it flows south from O'Neill Forebay.

Water is redirected into San Luis Reservoir during the fall, winter, and spring months when the two pumping plants usually can divert more water from the Delta than is needed for scheduled demands. Because the amount of water that can be diverted from the Delta is limited by available water supply, regulatory constraints, and the capacities of the two pumping plants, the fill and drawdown cycle of San Luis Reservoir is an extremely important element of project operations.

In April and May, export pumping from the Delta is limited during the State Water Board Decision 1641 San Joaquin River pulse period standards as well as by the Vernalis Adaptive Management Program. During this same time, SWP/CVP irrigation demands are increasing. Consequently, by April and May the San Luis Reservoir has begun the annual drawdown cycle. In some exceptionally wet conditions, when excess flood water supplies from the San Joaquin River or Tulare Lake Basin occur in the spring, the San Luis Reservoir may not begin its drawdown cycle until late in the spring.

In July and August, the Jones Pumping Plant diversion is at the maximum capability, and some CVP water may be exported using excess Banks Pumping Plant capacity as part of a Joint Point of Diversion (JPOD) operation. Irrigation demands are greatest during this period, and San Luis continues to decrease in storage capability until it reaches a low point late in August and the cycle begins anew.

San Luis Unit Operation

The operation of the San Luis Unit requires coordination between the SWP and CVP since some of its facilities are entirely owned by the State and others are joint use state and federal facilities. San Luis Unit annual water supply is contingent on coordination with SWP and CVP needs and capabilities. When the SWP excess export capacity is used to support additional pumping for the CVP under the JPOD allowance (see Section 5.2.2.2 on JPOD, below), it may be of little consequence to SWP operations but extremely critical to CVP operations. The availability of excess SWP export capacity for the CVP is contingent, in part, on the ability of the SWP to meet its SWP contractors' water supply commitments. Generally, the CVP will utilize excess SWP export capacity; however, there are times when the SWP may need to utilize excess CVP export capacity. Additionally, close coordination by SWP and CVP is required during this type of operation to ensure that water pumped into O'Neill Forebay does not exceed the CVP's capability to pump into San Luis Reservoir or into the San Luis Canal at the Dos Amigos Pumping Plant. Although secondary to water management concerns, power scheduling at the joint facilities also requires close coordination. Because of time-of-use power cost differences, both entities will likely want to schedule pumping and generation simultaneously. When facility capabilities of the two projects are limited, equitable solutions are achieved between the operators of the SWP and the CVP.

With the existing facility configuration, the operation of the San Luis Reservoir could impact the water quality and reliability of water deliveries to the San Felipe Division if San Luis Reservoir is drawn down too low. Reclamation has an obligation to address this condition and may solicit cooperation from DWR, as long as changes in SWP operations to assist with providing additional water in San Luis Reservoir (beyond what is needed for SWP deliveries and the SWP share of San Luis Reservoir minimum storage) does not impact SWP allocations and/or deliveries. If the CVP is not able to maintain sufficient storage in San Luis Reservoir, there could be potential impacts on resources in Santa Clara and San Benito Counties.

5.1.2.5 SWP and CVP Water Supplies and Deliveries

SWP Water Contracts

In the 1960s, DWR began entering into long-term water supply contracts (referred to as Table A Contracts) with 32 water districts or agencies to provide water from the SWP. Over the years, a few of these water agencies have been restructured, and today DWR has long-term Table A water supply contracts with 29 agencies and districts. These 29 contractors supply water to urban and agricultural water users in Northern California, the San Francisco Bay Area, the San Joaquin Valley, and Southern California. Of the contracted water supply, approximately three-quarters goes to M&I users, and one-quarter goes to agricultural users. Through these contracts, the SWP provides water to over 25 million people in California. The contracts are in effect for the longest of the following periods: the project repayment period that extends to the year 2035; 75 years from the date of the contract; or the period ending with the latest maturity date of any bond issued to finance project construction costs.

CVP Water Contracts

As the divisions of the CVP became operational, Reclamation entered into long-term contracts with water districts, irrigation districts, and others for delivery of CVP water. Approximately 250 contracts provide for varying amounts of water. Most of these original contracts were for a term of 40 years. The nature of the contracts vary, as some of the contracts were entered into with entities that claim water rights senior to the CVP, while other contracts are for water service. Some of the contracts, including the Sacramento River Settlement contracts, the San Joaquin Exchange Contracts, and certain refuge contracts, have defined minimum deliveries.

Reclamation renewed numerous contracts in 2005 consistent with the requirements of the CVPIA following issuance of the 2004 NMFS and 2005 USFWS BiOps regarding the long-term operations of the SWP and CVP. For the contracts not reviewed, Reclamation has executed interim water service contracts. Reclamation delivers water to the CVP contractors in accordance with contracts between Reclamation and the contractors.

Delta Water Exports

Delta exports and water deliveries to SWP and CVP contractors have increased since the CVP provided initial water deliveries starting in the 1940s. As described previously, California water demand has continued to increase as a consequence of population growth, expanded agricultural acreage in production, and, more recently, the dedication of water supplies for environmental needs. Figure 5-2 shows the increasing trend in annual Delta exports for the period 1956 through 2009 for CVP, SWP, Contra Costa Water District, and the North Bay Aqueduct. The figure also shows a timeline of the major changes that have affected water supplies and demands, such as the construction of the SWP in 1968 and CVP construction of the San Felipe Unit, as well as the implementation of the CVPIA. Exports exceeded 6 MAF in only a single year prior to 2000.

5.1.2.6 Regional and Local Diversions from the Delta

Several agencies and water districts divert water from the Delta for M&I uses and agricultural irrigation. Each is described below.

Freeport Regional Water Authority

The Freeport Regional Water Project (FRWP), completed in 2011, diverts up to a maximum of about 286 cfs from the Sacramento River near Freeport for Sacramento County and East Bay Municipal Utility District (EBMUD). EBMUD diverts water pursuant to its amended contract with Reclamation. Sacramento County diverts using its water rights and its CVP contract supply. Reclamation proposes to deliver CVP water pursuant to its respective water supply contracts with SCWA and EBMUD through the FRWP to areas in central Sacramento County. SCWA is responsible for providing water supplies and facilities to areas in central Sacramento County, including the Laguna, Vineyard, Elk Grove, and Mather Field communities, through a capital funding zone known as Zone 40.

The primary project components are (1) an intake facility on the Sacramento River near Freeport, (2) the Zone 40 Surface Water Treatment Plant (WTP) located in central Sacramento County, (3) a terminal facility at the point of delivery to the Folsom South Canal, (4) a canal pumping plant at the terminus of the Folsom South Canal, (5) an aqueduct pumping plant and pretreatment facility near Camanche Reservoir, and (6) a series of pipelines carrying water from the intake facility to the Zone 40 Surface WTP and to the Mokelumne Aqueducts. The existing Folsom South Canal is part of the water conveyance system.

North Delta Water Agency

The North Delta Water Agency (NDWA), which includes about 277,000 acres within the northern Sacramento and San Joaquin Delta, was created in 1973 by an act of the California Legislature. NDWA's primary purpose is to assure and protect the water supply and water quality for landowners within agency boundaries. NDWA entered into a contract with the DWR in 1981 to assure a dependable water supply of suitable quality. The contract provides that all agency water users may divert water from Delta channels for reasonable and beneficial uses on lands within the agency boundaries for agricultural and M&I purposes. The contract also provides that DWR shall furnish such water as may be required within NDWA to the extent not otherwise available under the individual water rights of the water users. The contract provides that water within the boundaries of NDWA will be of suitable quality through year-round criteria monitored at seven locations. These criteria prevent salt water intrusion or other factors from affecting the quality of water within NDWA.

Central Delta Water Agency

The Central Delta Water Agency (CDWA) was formed to assist landowners to protect and assure a dependable supply of water of suitable quality sufficient to meet existing and future needs. The agency encompasses approximately 120,000 acres in San Joaquin County, all of which is within the Sacramento-San Joaquin Delta. The lands within the CDWA are primarily agricultural but also contain recreational and significant wildlife habitat areas. These lands are dependent on water supply from in-channel Delta diversions for irrigation and other beneficial uses. The in-channel water supply is currently dependent on the flow and quality of both the Sacramento and San Joaquin River systems. All of the lands within the CDWA are contiguous to the channels and/or to the underground flow of water of those channels.

Contra Costa Water District Diversion Facilities

The CCWD diverts water from the Delta for irrigation and M&I uses under its CVP contract and under its own water right permits and license, issued by the SWRCB. The CCWD water system includes the Mallard Slough, Rock Slough, Old River, and Middle River (on Victoria Canal) intakes; the Contra Costa Canal and shortcut pipeline; and the Los Vaqueros Reservoir. The Rock Slough Intake facilities, the Contra Costa Canal, and the shortcut pipeline are owned by Reclamation, and operated and maintained by CCWD under contract with Reclamation. Mallard Slough Intake, Old River Intake, Middle River Intake, and Los Vaqueros Reservoir are owned and operated by CCWD.

The Mallard Slough Intake is located at the southern end of a 3,000-foot-long channel running south from Suisun Bay, near Mallard Slough (across from Chipps Island). The Mallard Slough Pump Station was refurbished in 2002, which included constructing a positive barrier fish screen at this intake. The Mallard Slough Intake can pump up to 39.3 cfs. CCWD’s water right license and permit (License No. 10514 and Permit No. 19856) authorize diversions of up to 26.78 TAF per year at Mallard Slough. However, this intake is rarely used due to the generally high salinity at this location. Pumping at the Mallard Slough Intake since 1993 has on average accounted for about 3 percent of CCWD’s total diversions. When CCWD diverts water at the Mallard Slough Intake, CCWD reduces pumping of CVP water at its other intakes.

The Rock Slough Intake is located about four miles southeast of Oakley, where water flows through a positive barrier fish screen into the earth-lined portion of the Contra Costa Canal. The fish screen at this intake was constructed by Reclamation in accordance with the CVPIA and the 1993 USFWS BO for the Los Vaqueros Project to reduce take of fish through entrainment at the Rock Slough Intake. The Canal connects the fish screen at Rock Slough to Pumping Plant 1, approximately four miles to the west. The Canal is earth-lined and open to tidal influence for approximately 3.7 miles from the Rock Slough fish screen. Approximately 0.3 miles of the Canal immediately east (upstream) of Pumping Plant 1 have been encased in concrete pipe, the first portion of the Contra Costa Canal Encasement Project to be completed.

Construction of the Old River Intake was completed in 1997 as a part of the Los Vaqueros Project. The Old River Intake is located on Old River near State Route 4. The intake has a positive-barrier fish screen and a pumping capacity of 250 cfs, and can pump water via pipeline either to the Contra

Costa Canal or to Los Vaqueros Reservoir. Diversions at Old River to the Contra Costa Canal are typically taken under CVP contract. Pumping to storage in Los Vaqueros Reservoir is limited to 200 cfs by the terms of the Los Vaqueros Project biological opinions and by SWRCB Decision 1629, the SWRCB water right decision for the Los Vaqueros Project (Permit 20749). In 2010, CCWD completed construction of the Middle River Intake (formerly referred to as Alternative Intake Project,) on Victoria Canal. The Middle River Intake has a capacity of 250 cfs capacity intake on Victoria Canal, with positive-barrier fish screens, and a conveyance pipeline to CCWD's existing conveyance facilities. Similar to the Old River Intake, the Middle River Intake can be used to either pump to the Contra Costa Canal or to fill Los Vaqueros Reservoir. Diversions to the Contra Costa Canal are typically taken under CVP contract, while diversions to storage in the Los Vaqueros Reservoir can be taken either under CVP contract or under CCWD's Los Vaqueros water right (Permit 20749).

Los Vaqueros Reservoir is an off-stream reservoir in the Kellogg Creek watershed to the west of the Delta. Originally constructed as a 100 TAF reservoir in 1997 as part of the Los Vaqueros Project, the facility is used to improve delivered water quality and emergency storage reliability for CCWD's customers. Los Vaqueros Reservoir is filled with Delta water from either the Old River Intake or the Middle River Intake, when salinity in the Delta is low. When Delta salinity is high, typically in the fall months, CCWD releases low salinity water from Los Vaqueros Reservoir to blend with direct diversions from the Delta to meet CCWD water quality goals. Releases from Los Vaqueros Reservoir are conveyed to the Contra Costa Canal via a pipeline.

In 2012, Los Vaqueros Reservoir was expanded from 100 TAF to a total storage capacity of 160 TAF to provide additional water quality and water supply reliability benefits, and maintain the initial functions of the reservoir. With the expanded reservoir, CCWD's average annual diversions from the Delta remain the same as they were with the 100 TAF reservoir. A Feasibility Study is ongoing to evaluate whether an additional expansion of this reservoir is in the Federal interest; a draft Feasibility Report is scheduled for completion by 2014.

Operations of CCWD owned facilities are governed by existing biological opinions issued to Reclamation under ESA Section 7. CCWD also has California Endangered Species Act take authorization for all of its operations under a 2081 permit issued in 2009 by the CDFW and amended by CDFW in 2012. The associated federal actions for the purposes of BDCP are only those operations of Reclamation owned facilities or operations involving Reclamation's SWRCB permits.

City of Stockton

The City of Stockton began operation of a 30-million-gallon-per-day (mgd) intake facility in 2012, as part of the Delta Water Supply Project (Phase 1) to divert water along the San Joaquin River at Empire Tract (City of Stockton 2011).

South Delta Water Agency

The principal purpose of the South Delta Water Agency (SDWA) is to protect the water supply of the lands within its boundaries against salinity intrusion and to assure a dependable supply of water of suitable quality to meet present and future needs. The area within the agency boundary (Middle Roberts, Upper Roberts, Union, Fabian Tract, and Stark Tract Islands) encompasses about 148,000 acres and is primarily agricultural with some municipal use. The primary source of water is in-channel water supply in the southern Delta from San Joaquin and Sacramento River flows that are diverted for irrigation and other beneficial uses via several small pumps and siphons.

City of Antioch

The City of Antioch has a water right on the Delta, and is a customer of the CCWD. Whenever the river salinity is at an acceptable level (chloride concentration less than 250 mg/L), the Delta water right is used (water diverted from San Joaquin River near Antioch Bridge). Whenever the river salinity level is unacceptable, or when demand exceeds the existing pumping capacity, the City purchases substitute or additional water supplies directly from the CCWD.

5.1.2.7 Delta Water Transfers

California water law and the CVPIA promote water transfers as an important water resource management tool to address water shortages, provided that certain protections to source areas and users, as well as to the affected environmental resources, are incorporated into the water transfer. Parties seeking water transfers generally acquire water from willing sellers who have surplus reservoir storage water, sellers who can pump groundwater instead of using surface water, or sellers who will fallow crops or substitute a crop that uses less water in order to reduce normal consumptive use of surface diversions.

Water transfers involving the SWP and CVP occur when a water agency or a water right holder within the Sacramento–San Joaquin River watershed willingly undertakes actions to make non-project water available for transfer that requires export from the Delta through SWP and/or CVP facilities to a willing buyer, or in some cases, for in-Delta environmental uses. Transfers from a willing seller to a willing buyer are the most common cross-Delta transfers and are the main subject of the analysis in this section.

There is a potential for other voluntary water market transactions that could be conveyed to the Delta for export or environmental purposes. These could include exchanges of non-project water, coordinated or integrated operations of projects other than the SWP or CVP, or sales of water rights that could be used to supplement project water supplies or for increasing in-stream flows. These other types of transactions are not discussed in detail in this section, but would most likely come from some of the same sources and have similar constraints and in-Delta impacts as the water transfers that are addressed. Water transfers and/or exchanges of SWP or CVP project water among SWP or CVP contractors or coordination of operations relating to SWP/CVP operations are covered as part of CVP/SWP operations and are therefore not analyzed in this discussion.

This EIR/EIS provides project-level CEQA/NEPA coverage for the flow of water in-Delta and south-of-Delta associated with all project and non-project water transactions. There is no maximum on the amount of water that can be conveyed through or delivered from the Delta as long as it is consistent with the operational criteria described in *CM1 Water Facilities and Operation* and the effects analysis described in BDCP Chapter 5, *Effects Analysis,* and it is not limited by other factors including hydrological, regulatory and contacts conditions. Because specific agreements have not been identified for water transfers and other non-project voluntary water market transactions, project-level analysis of impacts upstream of the Delta is highly speculative and this EIR/EIS does not constitute the CEQA/NEPA coverage required for any specific transaction. Rather, it provides an analysis of how transfers relate to the BDCP facilities. Any future water transfers will require separate approvals as outlined below. The analysis of any potential upstream impacts is not a part of this EIR/EIS and must be covered pursuant to separate laws and regulations once the specific transfer has been proposed.

Transfers requiring export from the Delta are done at times when pumping and conveyance capacity at the CVP or SWP export facilities is available to move the water. As such, operations to accomplish these transfers must be carried out in close coordination with SWP and CVP operations, such that the capabilities of the projects to exercise their own water rights or to meet their legal and regulatory requirements are not diminished or limited in any way. Parties to water transfers are responsible for providing for any incremental changes in flows required to protect Delta water quality standards. All transfers must be in accordance with all existing regulations and requirements. Purchasers of water for water transfers may include Reclamation, DWR, SWP contractors, CVP contractors, other State and federal agencies, or other parties.

The analyses presented in this section of Chapter 5 are supported by Appendices 1E, 5C, and 5D, which primarily focus on cross-Delta transfers. Appendix 1E provides a general description of the types of water transfers in California, their recent history, and the general regulatory setting for transfers. Appendix 5C provides a more complete description of past and present transfer programs with a discussion of the potential source regions for cross-Delta transfers. Both Appendix 5C and Section 30.3.6 describe the general types of environmental impacts that could be associated with those transfers. Appendix 5D presents the technical support for the analyses presented in this section of Chapter 5.

DWR and Reclamation have operated water acquisition programs in the past to provide water for environmental programs and additional supplies to SWP contractors, CVP contractors, and other parties. The DWR programs include the 1991, 1992, and 1994 Drought Water Banks, and Dry Year Programs in 2001, 2002, and 2009. Reclamation operated a forbearance program in 2001 by purchasing CVP contractors' water in the Sacramento Valley for CVPIA in-stream flows, and to augment water supplies for CVP contractors south of the Delta and wildlife refuges. Reclamation administers the CVPIA Water Acquisition Program for Refuge Level 4 supplies and fishery in-stream flows.

DWR and Reclamation also administered the water acquisition activities of the CALFED Environmental Water Account from 2000 through 2007, acquiring transfer water from willing sellers to offset export pumping curtailments to benefit the listed species of fish in the Delta. Many of these water acquisitions involved water transfer through the Delta.

SWP and CVP contractors as well as other agencies have also independently acquired water and requested conveyance through SWP facilities. State Water Code provisions require that the owners of conveyance facilities cannot deny other parties access to unused conveyance capacity if the transfer will not harm other legal users, and will not unreasonably affect fish and wildlife resources or the economy of the county from which the water is transferred (Water Code Section 1810 et seq). SWP contractors have priority access to capacity not being used by the DWR to meet SWP contract amounts.

The Yuba River Accord, finalized in 2008, also involves a water transfer program as one important element. The Yuba Accord includes three separate but interrelated sets of agreements designed to accomplish the following objectives: protect and enhance fisheries resources in the lower Yuba River through a new flow schedule; increase local water supply reliability through conjunctive management of groundwater resources; provide DWR and Reclamation with water to help offset export pumping reductions required under the biological opinions for protection of Delta fisheries resources; and provide added dry-year water supplies to state and federal water contractors.

The SWP and CVP may provide Delta export pumping for transfers using pumping capacity at Banks and Jones beyond that which is being used to deliver project water supply, up to the physical capacity of the pumps, consistent with prevailing operational constraints. These constraints include requirements contained in Water Right Decision 1641 (SWRCB D-1641), the 2008 and 2009 Biological Opinions issued by USFWS and NMFS for the Coordinated Long-Term Operations of the CVP and SWP, the Corps of Engineers (COE) Permit Number 199900715 authorizing diversions into Clifton Court Forebay, and any other requirements in effect at the time of the transfer.

The biological opinions specifically considered the effects of water transfers up to 600,000 acre-feet/year in critical year types and dry year types immediately following critical or dry year types, and up to 360,000 acre-feet/year in all other years. The BiOps currently limit export of transfer water to July through September. The project description considered in the biological opinions requires additional consultation with USFWS and NMFS for water transfers that occur during October through June or in excess of the analyzed amounts. (Bureau of Reclamation 2008a; U.S. Fish and Wildlife Service 2008:129; National Marine Fisheries Service 2009: Appendix I).In addition, transfers can only be exported by SWP and CVP Delta export pumps when all other requirements for the protection of Delta water levels, water quality, and fisheries are being met in accordance with applicable permits and regulations, including BDCP permit terms, and when other beneficial uses are not adversely affected. The availability of surplus export capacity available for transfers varies a great deal. In general, as hydrologic conditions get wetter, surplus capacity diminishes because the SWP and CVP are more fully using export pumping capacity for project supplies.

The CVP's Jones Pumping Plant, with no forebay to regulate the intake of water for export and with limited capability to fine-tune rates of pumping, has little surplus capacity, except in the driest hydrologic conditions. The SWP, with Clifton Court Forebay to regulate water for export and a more flexible pumping configuration, has the most surplus export capacity, with the greatest amount available in critical years and many dry years when water allocations are low. SWP pumping capacity may also be available in some above normal and wet years when some contractor's demands may be lower as a result of increased availability of alternative supplies. The least surplus export capacity occurs in a broad middle range of hydrologic conditions when water allocations and demands are high.

Under these existing transfer export constraints, some water transfers (i.e. those based on crop idling and crop shifting in the Sacramento River region) are currently uneconomical because the water generated by idling crops is released to the river throughout the irrigation season and is thereby made available from April into October and becomes Delta inflow during that same period. However, that transfer water can only be exported between July 1 and September 30 under current regulatory constraints resulting in the April, May, June, and October releases becoming part of Delta outflow unless upstream storage capacity is available. Up to 40 percent of the crop idling transfer water may be generated outside of the July-September summer transfer window and be unavailable for export to the buyer. Transfer water made available from agencies on the Sacramento River can not be held in Shasta Reservoir due to Sacramento River temperature and flow requirements, and as a result, the April, May, June, and October releases are lost to the transfer buyer. Consequently, crop idling transfers in that basin have been limited in recent years.

Transfer water made available from crop idling and crop shifting from sellers who divert from Thermalito Afterbay on the Feather River immediately downstream of Oroville Reservoir can, under certain conditions, be retained in Oroville Reservoir for SWP contractors for later release during the transfer window, thereby avoiding that loss of transfer water.

The allowable transfer window also limits the amount of the transfer generated by groundwater substitution transfers as well by limiting the time when the groundwater substitution pumping can occur. If the transfer window restriction was removed, groundwater substitution pumping could occur throughout the entire irrigation season. As noted above in the discussion of crop idling transfers, agencies diverting from Thermalito Afterbay may not face the same transfer window limitations due to potential access to Oroville storage for SWP buyers. In addition, the YCWA member units may provide groundwater substitution supplies under the Yuba Accord water purchase agreement, and groundwater pumping can occur during the full agricultural season, assuming Bullards Bar Reservoir can reduce releases in the spring and accrue the substitution water in the reservoir depending on Yuba River hydrology, allowing YCWA to retain the conserved surface supply in Bullards Bar Reservoir for release during July and August. Yuba also releases during July and August those groundwater substitution supplies that are committed to be generated in September and October.

The availability of water for transfer and the demand for transfer water vary with hydrologic conditions. Accordingly, because many transfers are negotiated between willing buyers and willing sellers under prevailing hydrologic and market conditions, price of water may be an important factor determining how much is transferred in any year. The capability to export transfers is also often capacity-limited.

5.2 Regulatory Setting

This section describes the laws, regulations, and policies that affect California water supply and the water rights and operations of the SWP and CVP.

5.2.1 Federal Plans, Policies, and Regulations

5.2.1.1 Federal Regulations Related to SWP and CVP Authorization and Operations

In the early 1900s, the federal government and the State of California initiated several projects that coordinated water supply, flood control, and navigation benefits. One of the first California projects was proposed in 1920 by Colonel Marshall of the U.S. Geological Survey (The Marshall Plan) to construct Shasta and Friant dams and associated facilities to provide water supplies and reduce groundwater overdraft in the San Joaquin Valley. In 1933, the State Legislature adopted the California Central Valley Project Act to sell revenue bonds for the facilities. However, because of economic conditions, the bonds could not be sold, and federal government assistance was requested. The Federal River and Harbor Act of 1935 (Public Law 74-409) appropriated funds and authorized USACE to construct Shasta and Friant dams, power generating and transmission facilities, and the Contra Costa, Madera, and Friant-Kern canals. In 1937, Congress reauthorized the River and Harbor Act (Public Law 75-392), which included a provision to assign construction and operation of CVP to the Reclamation Service (later known as the Bureau of Reclamation). This resulted in CVP being subject to Reclamation Law as defined in the Reclamation Act of 1902 (82 Stat. 388) and all acts amendatory thereof and supplemental thereto, referred to as Reclamation Law. Under Reclamation

Law, the Secretary of Interior administers the laws governing the distribution of benefits associated with construction, operation, and maintenance of federal reclamation facilities that provide water for irrigation farmland and other enumerated purposes.

Congress authorized the construction of other facilities to be included as parts of CVP over the next 50 years, including the American River Division in 1949 (Public Law 81-356), Sacramento River Division in 1950 (Public Law 81-839), Integration of Waterfowl Management with the CVP (Public Law 83-674), Trinity River Division in 1955 (Public Law 84-386), San Luis Unit in 1960 (Public Law 86-488), New Melones Dam in 1962 (Public Law 87-874), Auburn-Folsom South Unit in 1965 (Public Law 89-161), and San Felipe Division 1967 (Public Law 90-72).

Several other laws were adopted that provided reauthorization or further definition of authorizations for CVP facilities, operations, water service contracting, and environmental protections. One of the most recent laws, the CVPIA (Public Law 102-575), substantially amended the CVP authorizations. CVP operations were also substantially modified through adoption of the COA, CALFED Bay-Delta Authorization Act (Public Law 108-361), implementation of the Trinity ROD, and the SJRA and the San Joaquin River Restoration Settlement Act (Public Law 111-11).

Implementation of the Central Valley Project Improvement Act

The CVPIA amended previous authorizations of the CVP in 1992 to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic water supply uses, and fish and wildlife enhancement having an equal priority with power generation. Among the changes mandated by the CVPIA are as follows.

- Dedicating 800,000 af of project yield annually to fish, wildlife, and habitat restoration—Section 3406(b)(2).
- Authorizing water transfers outside the CVP service area—Section 3405.
- Implementing an anadromous fish restoration program—Section 3406(b)(1).
- Creating a restoration fund financed by water and power users—Section 3407.
- Providing for the Shasta temperature control device—Section 3406(b)(6).
- Implementing fish passage measures at Red Bluff Diversion Dam—Section 3406(b)(10).
- Calling for planning to increase the CVP yield—Section 3406(j).
- Mandating firm water supplies for Central Valley wildlife refuges and wildlife habitat areas—Section 3406(d).
- Improving the TFCF—Section 3406(b)(4).
- Meeting federal trust responsibility to protect fishery resources in the Trinity River—Section 3406(b)(23).

CVP operations reflect provisions of the CVPIA. CVPIA provisions relate in part to environmental uses of water including dedication of

af of CVP yield annually to fish, wildlife, and habitat restoration under Section 3406(b)(2), which is implemented pursuant to the May 9, 2003, Decision on Implementation of Section 3406(b)(2) of the CVPIA issued by the Department of the Interior. Depending on circumstances, instream flow augmentation occurs on Clear Creek below Whiskeytown Dam, Sacramento River below Keswick

Dam, lower American River below Nimbus Dam, and Stanislaus River below Goodwin Dam; and exports can be reduced at Jones Pumping Plant.

Coordinated Operations Agreement

SWP and CVP use a common water supply in the Delta. The associated water rights are conditioned by the State Water Board for the protection of beneficial uses in the Sacramento Valley and the Delta estuary. The COA (Public Law 99-546), signed in 1986, defines the SWP and CVP facilities and their water supplies, sets forth procedures for coordination of operations, identifies formulas for sharing responsibilities for meeting Delta standards as the standards existed in State Water Board Decision 1485 and other legal uses of water (as described subsequently under Section 5.2.2), identifies how unstored flow will be shared, sets up a framework for exchange of water and services between SWP and CVP, and provides for periodic review of the agreement.

In-basin uses, or legal uses of water in the Sacramento Basin as defined by the COA, include water required under State Water Board Decision 1485 Delta standards for water quality protection for agricultural, M&I, and fish and wildlife use. SWP and CVP are obligated to ensure water is available for these uses, but the degree of obligation depends on several factors and changes throughout the year. Balanced water conditions are defined in the COA as periods when it is mutually agreed that releases from upstream reservoirs, plus unregulated flows, approximately equal the water supply needed to meet Sacramento Valley in-basin uses plus exports. Excess water conditions are periods when it is mutually agreed that releases from upstream reservoirs plus unregulated flow exceed Sacramento Valley in-basin uses plus exports. During excess water conditions, sufficient water is available to meet all beneficial needs, and SWP and CVP are not required to supplement the supply with water from reservoir storage. During balanced water conditions, SWP and CVP share the responsibility in meeting in-basin uses. When water must be withdrawn from reservoir storage to meet in-basin uses, 75% of the responsibility is borne by CVP and 25% is borne by SWP. When unstored water is available for export while balanced water conditions exist, the sum of CVP stored water, SWP stored water, and the unstored water for export is allocated 45 and 55% to SWP and CVP, respectively.

Implementation of the COA principles has evolved since 1986 because of changes in facilities, including the North Bay Aqueduct, as well as new water quality and flow standards established by State Water Board Decision 1641 and USFWS and NMFS BiOps. For example, water temperature controls at Shasta, Trinity, and Whiskeytown dams have changed the pattern of storage and withdrawals for the purpose of improving temperature control and managing coldwater pool resources. Such constraints have reduced CVP's capability to respond efficiently to changes in Delta export or outflow requirements. Periodically, temperature requirements have caused the timing of the CVP releases to be substantially mismatched with Delta export capability, resulting in loss of water supply. On occasion, and in accordance with Articles 6(h) and 6(i) of the COA, SWP has been able to export water released by CVP for temperature control in the Sacramento River. The installation of the Shasta Temperature Control Device has substantially improved Reclamation's ability to match reservoir releases and Delta needs.

The CALFED Bay-Delta Implementation Act

In the CALFED ROD (August 28, 2000), several state and federal agencies committed to implementing a long-term plan to restore the Bay-Delta. This plan consists of many activities including storage, conveyance, ecosystem restoration, levee integrity, watersheds, water supply reliability, water use efficiency, water quality, water transfers, and science. The Implementation Memorandum of Understanding, also signed August 28, 2000, and amended in September, 2003, continued the operations decision-making process that had evolved through the CALFED process. The ROD identified numerous programs, including the Environmental Water Account (EWA), to provide protection to fish in the Bay-Delta Estuary through environmentally beneficial changes in SWP and CVP operations at no loss of uncompensated water cost to SWP and CVP water users. This project expired in 2009; however, specific provisions may be considered in future operations.

Trinity River Mainstem Fishery Restoration

In 1994, USFWS, as the National Environmental Policy Act lead agency, and Trinity County, as the California Environmental Quality Act lead agency, began the public process for developing the Trinity River Mainstem Fishery Restoration EIS/EIR. In December 2000, the Secretary of Interior signed the ROD for a variable annual flow regime, mechanical channel rehabilitation, sediment management, watershed restoration, and adaptive management. Based on the ROD, 368,600 af to 815,200 af (depending on water year type) is allocated annually for Trinity River flows. This amount is scheduled in coordination with USFWS to best meet habitat, temperature, and sediment transport objectives in the Trinity River basin.

5.2.1.2 National Marine Fisheries Service and U.S. Fish and Wildlife Service Biological Opinions for Continued Long-Term Operation of the CVP/SWP

Federal agencies are required to consult with USFWS and/or NMFS in accordance with the federal Endangered Species Act to ensure that actions they authorize, fund, or implement are not likely to jeopardize the continued existence of federally-listed threatened or endangered species, or result in the destruction or modification of designated critical habitat of these species. The federal action agency frequently prepares a biological assessment describing the proposed action which may affect listed species or designated critical habitat and the anticipated effects on the federally-listed species or critical habitat. The USFWS and NMFS prepare BiOps to evaluate the effects of the federal action. If jeopardy to the federally-listed species is likely, the BiOp may include a suggested RPA to the proposed action.

In the early 1990s, USFWS and NMFS issued the initial BiOps for aquatic species as related to coordinated long-term operations of the CVP and SWP. Throughout the last 20 years, populations of delta smelt, some salmon runs, and green sturgeon in the Sacramento and San Joaquin rivers watersheds have continued to decline and new BiOps have been issued.

The most recent BiOps were issued by USFWS and NMFS in 2008 and 2009, respectively. In December 2008, USFWS issued a BiOp for delta smelt and its critical habitat, and Reclamation provisionally accepted and began implementing the RPA. The California Department of Fish and Wildlife issued Consistency Determinations on each of these BiOps to DWR to provide compliance with CESA. In June 2009, NMFS issued a new BiOp for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, Southern distinct population segment of North American green sturgeon, and Southern resident killer whales and their critical habitat, and Reclamation provisionally accepted and began implementing the RPA.

Several lawsuits were filed challenging portions of the USFWS and NMFS BiOps and Reclamation's acceptance of the BiOps. The U.S. District Court for the Eastern District of California remanded certain portions of the BiOps to USFWS and NMFS for further consideration, and ordered Reclamation to complete the review of the remanded BiOps in accordance with the National Environmental Policy Act (NEPA) prior to implementation of operations in accordance with revised BiOps. USFWS and NMFS have initiated review of the BiOps and Reclamation has initiated the NEPA process (77 FR 18858). These cases are under review by the Ninth Circuit Court of Appeals. Pending completion of the remand, the CVP and SWP are being operated in accordance with the 2008 USFWS and 2009 NMFS BiOps as ordered by the District Court.

Under the 2008 USFWS and 2009 NMFS BiOps, CVP and SWP operations include the previous operational requirements of State Water Board Decision 1641 additional operational requirements. The additional requirements of the 2008 USFWS and 2009 NMFS RPAs and DFW consistency determinations for DWR, as compared to the requirements of State Water Board Decision 1641, are summarized below. Detailed assumptions for SWP and CVP operations are represented in the hydrological and water quality models, as described in Appendix 5A, *BDCP EIR/S Modeling*.

The 2008 USFWS BiOp includes adaptively managed flow limits in Old and Middle rivers from December–June. The Old and Middle River OMR flow limits reduce the allowable negative flow in Old and Middle rivers based on specific conditions, including turbidity, fish distribution and life stage. The RPA has three phases of OMR flow limits that are intended to protect delta smelt at various life stages. The 2008 USFWS BiOp RPA includes methods to determine the minimum allowable flow. The 2008 USFWS BiOp RPA also includes a Delta salinity requirement (commonly referred to as X2) in September and October in wet and above normal water years (in addition to the X2 requirement that was included in State Water Board Decision 1641 in the spring months). This new requirement is frequently referred to as “Fall X2.” The RPA requires that 2 psu salinity is maintained at or to the west of 74 km during wet years, and 81 km during above normal water years. In November, the projects are required to add reservoir releases up to natural inflow as needed to continue to meet monthly average X2 requirements. There is no Fall X2 requirement in critical, dry and below normal water years.

Throughout the remaining portions of this and the following chapters, references to the USFWS BiOp are specifically referring to the 2008 USFWS BiOp and the associated RPA.

NMFS BiOp RPA includes criteria for CVP and SWP operations that are intended to be more protective for listed species under NMFS jurisdiction than State Water Board Decision 1641. The NMFS BiOp RPA includes criteria for Old and Middle River flows limiting negative flows from January through June. The OMR flow ranges in the NMFS 2009 BiOp, similar to those in the 2008 USFWS BiOp RPA, are implemented and adjusted based on different factors and conditions.

The 2009 NMFS BiOP RPA extends the SWRCB D-1641 San Joaquin River spring pulse-flow requirement from 31 days to 61 days for interim operations. For the long-term operations, the BiOp requires that project exports do not exceed specified ratios of San Joaquin River flow during that same period.

The 2009 NMFS BiOp RPA requires more DCC closures in fall and winter as compared to the SWRCB D-1641. Under the 2009 NMFS BiOp RPA, the Delta Cross Channel gates are closed more frequently from October through December 14 as compared to State Water Board D-1641, and completely closed between December 15 and January 31. For additional discussion see Section 5.1.2.1 (Delta Division).

The 2009 NMFS BiOp RPA also includes temperature and flow criteria for the upstream CVP and SWP reservoirs that are more protective than previous NMFS BiOps issued for continued long-term operations of the CVP and SWP.

Throughout the remaining portions of this and the following chapters, references to the NMFS BiOp are specifically referring to the 2009 NMFS BiOp and the associated RPA.

Federal Power Act

DWR operates Oroville's facilities as a multipurpose water supply, flood management, power generation, recreation, fish and wildlife enhancement, and salinity control project. The Federal Power Act (FPA) requires that DWR have a license from the FERC to operate the Oroville Facilities, FERC No. 2100. For the past 50 years, DWR has operated the Oroville Facilities under a license issued by the Federal Power Commission (precursor to FERC) that expired on January 31, 2007. Before this expiration, DWR filed an application for a new license with FERC for the continued operation of the facilities, and FERC initiated a formal license proceeding on DWR's application. On March 24, 2006, DWR filed a comprehensive settlement agreement with FERC that is intended to result in the issuance of a new license for up to 50 years. Signatories to the agreement include DWR, Interior, United States Forest Service, NMFS, Pacific Gas and Electric Company (PG&E), State Water Contractors, and American Rivers. The settlement agreement is currently pending before FERC. DWR is operating the Oroville facilities pursuant to an annual license issued by FERC until FERC issues a new license for the facilities.

5.2.1.3 U.S. Army Corps of Engineers Public Notice 5820A (13 October 1981)

Under the authority of Section 10 of the Rivers and Harbors Act of 1899, the USACE determined that DWR would not require additional USACE permitting for the SWP's diversions from the Delta as long as the SWP is limited to daily diversion into Clifton Court Forebay that would not exceed 13,870 af and the 3-day average diversions into Clifton Court Forebay would not exceed 13,250 acre feet. In addition, the SWP can increase diversions into Clifton Court Forebay by one third of the San Joaquin River flow at Vernalis during the period from mid-December to mid-March when the flow of the San Joaquin River at Vernalis exceeds 1,000 cfs.

5.2.2 State Plans, Policies, and Regulations

5.2.2.1 State Regulations Related to SWP Authorization and Operations

DWR was established in 1956 as the successor to the Department of Public Works for authority over water resources and dams in California. DWR also succeeded to the Department of Finance's powers with respect to State application for the appropriation of water[8] and has permits for appropriation from the State Water Board for use by the SWP. DWR's authority to construct State water facilities or projects is derived from the Central Valley Project Act (CVPA), the Burns-Porter Act (California Water Resources Development Bond Act), the State Contract Act, the Davis-Dolwig Act, and special

[8] Stats. 1956, First Ex. Sess., Ch. 52; see also Wat. Code Sec. 123.

acts of the State Legislature.[9] Although the federal government built certain facilities described in the CVPA, the Act authorizes DWR to build facilities described in the Act and to issue bonds.[10] The CVPA describes specific facilities that have been built by DWR, including the Feather River Project and California Aqueduct, Silverwood Lake, and the North Bay Aqueduct.[11] The Act allows DWR to administratively add other units and develop power facilities.[12]

The Burns-Porter Act, approved by the California voters in November 1960, authorized issuance of bonds for construction of the SWP. The principal facilities of the SWP are Oroville Reservoir and related facilities, and San Luis Dam and related facilities, Delta facilities, the California Aqueduct, and the North and South Bay Aqueducts. The Burns-Porter Act incorporates the provisions of the CVPA. DWR is required to plan for recreational and fish and wildlife uses of water in connection with State-constructed water projects and can acquire land for such uses.[13] The Davis-Dolwig Act establishes the policy that preservation of fish and wildlife is part of State costs to be paid by water supply contractors, and recreation and enhancement of fish and wildlife are to be provided by appropriations from the General Fund.

5.2.2.2 California State Water Resources Control Board

Water rights and water quality regulations that directly affect water supply operations are summarized below. Detailed descriptions of these criteria are included in Appendix 5A, *BDCP EIR/S Modeling* that describes the assumptions in the hydrologic and water quality models.

SWP Water Rights

Under California law, diversions of appropriated water since 1914 require a permit from the State Water Board. DWR has State Water Board permits and licenses to appropriate water for the SWP. These permits have terms that must be followed by DWR as the permit holder. The State Water Board has issued several decisions and orders that have modified DWR's permits, many of which are the same decisions and orders that affect Reclamation CVP operations. WR Order 98-09, Decision 1485, and Decision 1641, are discussed below.

CVP Water Rights

Federal law provides that Reclamation obtain water rights for its projects and administer its projects pursuant to State law relating to the control, appropriation, use, or distribution of water used in irrigation, unless the State law is inconsistent with clear Congressional directives.[14]

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[9] Central Valley Project Act (CVPA): Wat. Code Sec. 11100 et seq.). Burns-Porter Act (California Water Resources Development Bond Act): Wat. Code Sec. 12930-12944). State Contract Act: Pub. Contract Code Sec. 10100 et seq. Davis-Dolwig Act: Wat. Code Sec. 11900-11925.

[10] See Warne v. Harkness, 60 Cal. 2d 579 (1963).

[11] Feather River Project and California Aqueduct: Wat. Code Sec. 11260. Silverwood Lake: Wat. Code Sec. 11261. North Bay Aqueduct: Wat. Code Sec. 11270.

[12] Wat. Code Sec. 11290 and 11295, respectively.

[13] Wat. Code Sec. 233, 345, 346, 12582.

[14] See 43 United States Code (USC) §383; California v. United States, 438 U.S. 645, 678 (1978); appeal on remand, 694 F.2d 117 (1982).

Reclamation was issued water rights by State Water Board to appropriate water for the CVP. Many of the rights for the CVP were issued pursuant to State Water Board D-990, adopted in February 1961. Several other decisions and State Water Board actions cover the remaining rights for the CVP. These rights contain terms and conditions that must be complied with in the operation of the CVP.

Decisions Affecting SWP and CVP Water Rights

Over time, State Water Board has issued further decisions that modify the terms and conditions of CVP water rights. In August 1978, State Water Board adopted the WQCP for the Delta and Suisun Marsh, which established revised water quality objectives for flow and salinity in the Delta and Suisun Marsh. In Decision 1485, also adopted in August 1978, State Water Board required Reclamation and DWR to operate the SWP and CVP to meet all of the 1978 WQCP objectives, except some of the salinity objectives in the southern Delta. In addition, State Water Board issued D-1594 in November 1983, and Order WR 84-2 in February 1984, defining Standard Permit Term 91 to protect SWP and CVP stored water from diversion by others. Permit terms and requirements, as they relate to operations, are discussed in the 2008 and 2009 USFWS and NMFS BiOps.

On May 22, 1995, State Water Board adopted a WQCP for the San Francisco Bay/Sacramento–San Joaquin Delta (Bay-Delta) Estuary (1995 Bay-Delta Plan). The 1995 Bay-Delta Plan superseded both the 1978 and 1991 plans. On December 29, 1999, State Water Board adopted (and then revised on March 15, 2000) Decision 1641, amending certain terms and conditions of the water rights of the SWP and CVP. Decision 1641 substituted certain objectives adopted in the 1995 Bay-Delta Plan for water quality and flow objectives required to be met as terms and conditions of the water rights of the DWR and Reclamation. Permit terms and requirements, as they relate to operations, are discussed below. On December 13, 2006, State Water Board adopted an amended WQCP for the Bay-Delta, which became effective June, 2007. The State Water Board resolution adopting the WQCP stated that State Water Board did not believe there were any substantive changes to water quality standards from the 1995 Bay-Delta Plan.

Water Right Decisions 1422 and 1275

Individual water rights for CVP are granted for the Sacramento, Trinity, American, San Joaquin, and Stanislaus rivers and several of their tributaries. Water Right D-1422, issued in 1973, and State Water Board Water Right Order 83-3, issued in 1983 (collectively referred to as D-1422), provided the water rights and primary operational criteria for New Melones Reservoir. D-1422 included requirements for water quality conditions on the San Joaquin River at Vernalis.

Water rights for SWP were granted in 1967 through Water Rights D-1275. This decision also included water quality criteria in the Delta to be implemented with SWP and CVP.

Water Right Decision 1485

In 1975 and 1976, State Water Board adopted the Sacramento–San Joaquin Delta Basin and San Francisco Bay Basin plans, which included water quality standards. These plans formed the basis for the WQCP for the Delta and Suisun Marsh adopted in 1978 (1978 Delta Plan). This plan included salinity objectives in the Delta for protection of agricultural uses. In 1978, State Water Board also adopted Water Right Decision 1485 to implement portions of the plan through modification of SWP and CVP operations. Reclamation and DWR protested many of the requirements of Decision 1485, including the ability of new water rights applicants to change Delta inflows that would need to be corrected through modification of SWP and CVP operations to continue to meet Delta water quality requirements.

1995 Water Quality Control Plan

The State Water Board adopted the 1995 Bay-Delta Plan on May 22, 1995, which became the basis of Water Right Decision 1641. The State Water Board amended the WQCP in 2006, as described below.

Water Right Decision 1641

Water Right Decision 1641 implements the objectives set forth in the State Water Board's 1995 Bay-Delta WQCP and requires the projects to meet flow and water quality objectives to assure protection of beneficial uses in the Delta. The State Water Board also grants conditional changes to points of diversion for each project with Decision 1641 including authorizing the SWP and CVP to jointly use each others' points of diversion in the Southern Delta. The various flow objectives and export reductions are designed to protect fisheries. These objectives include specific outflow requirements throughout the year, specific export reductions in the spring, and export limits based on a percentage of estuary inflow throughout the year. The water quality objectives are designed to protect agricultural, M&I, and fishery uses, and they vary throughout the year and by the wetness of the year. Decision 1641 also authorizes SWP and CVP to jointly use each other's points of diversion in the southern Delta, with conditional limitations and required response coordination plans. Decision 1641 modified the Vernalis salinity standard under D-1422 to the corresponding Vernalis salinity objective in the 1995 Bay-Delta Plan.

These objectives will remain in place until such time that the State Water Board revisits them per petition or as a consequence to revisions to the State Water Board Water Quality Plan for the Bay-Delta (which is revisited periodically). The State Water Board is currently undertaking a review of the Bay-Delta Water Quality Control Plan.

Joint Points of Diversion

Decision 1641 granted Reclamation and DWR the ability to use/exchange each project's diversion capacity capabilities to enhance the beneficial uses of both projects. The State Water Board conditioned the use of JPOD capabilities based on a staged implementation and conditional requirements for each stage of implementation. Three stages of JPOD are listed in Decision 1641.

- Stage 1: for water service to Cross Valley Canal contractors, Tracy Veterans Cemetery and Musco Olive, and to recover export reductions taken to benefit fish.
- Stage 2: for any purpose authorized under the current project water right permits.
- Stage 3: for any purpose authorized up to the physical capacity of the diversion facilities.

Each stage of JPOD has regulatory terms and conditions that must be satisfied to implement JPOD.

All stages require a response plan to ensure that water levels in the southern Delta will not be lowered to the injury of local riparian water users (Water Level Response Plan). All stages require a response plan to ensure the water quality in the southern and central Delta will not be significantly degraded through operations of the JPOD to the injury of water users in the southern and central Delta.

All JPOD diversion under excess conditions in the Delta is junior to CCWD water right permits for the Los Vaqueros Project, and must have an X2 location west of certain compliance locations consistent with the 1993 Los Vaqueros BiOp for delta smelt.

Water Transfers

The California Water Code provides the framework of the regulatory process that governs water transfers in California. The State Water Board has responsibility for administering appropriative water rights in the state. Water rights subject to transfer by a willing seller are regulated by the board in different ways, as outlined below.

California's surface water system primarily involves a blend of two different kinds of water rights: riparian and appropriative. Riparian rights attach to the land that is adjacent to a source of water, and entitle the landowner to use a correlative share of the water flowing past his or her property. Riparian rights do not require permits, licenses, or government approval, but they apply only to the water which would naturally flow in the adjacent stream. Riparian rights attach to the land abutting a watercourse and are limited to the direct diversion of available natural flow. Water available under riparian rights is generally not transferrable, with the exception of petitions to transfer water for instream flow filed with the State Water Board under Water Code Section 1707, and therefore are not addressed further here.

The Water Commission Act of 1914 established the current water right permit process. The Act created the agency that later evolved into the State Water Board and granted it the authority to administer permits and licenses for California's surface water. The act was the predecessor to today's Water Code provisions governing appropriation. Water rights established before the Act are termed pre-1914 rights, and are governed by different rules than post-1914 rights.

The priority of appropriative rights in California is based on the rule of "first in time, first in right". In times of shortage, the most recent ("junior") right holder must be the first to discontinue such use. The priority of a pre-1914 water right dates to the time when a notice of intent to appropriate was posted or the water was first put to beneficial use. For post-1914 water rights, each right's priority dates to the time the permit application was filed with the State Water Board. Although pre- and post-1914 appropriative rights are similar, post-1914 rights are subject to a much greater degree of scrutiny and regulation by the State Water Board.

With respect to groundwater, in most areas of California, overlying land owners may extract ground water and put it to beneficial use without approval from the State Water Board or a court. California does not have a permit process for regulation of groundwater use. However, in a number of groundwater basins, groundwater use is subject to regulation as the result of an adjudication of the ground water rights within the basins. Groundwater use may also be restricted as a result of local ordinances.

Pre-1914 rights holders can change the purpose of use, place of use or points of diversion without notifying the State Water Board; however, the "no injury rule" applies to pre-1914 water rights (Water Code Section 1706) (see discussion below of "no injury rule"). The transfer of a pre-1914 water right does not require approval of the State Water Board, but does require compliance with CEQA, and if a federal action is involved, appropriate environmental documentation to comply with NEPA and ESA must be completed. For cross-Delta transfers requiring Reclamation approval, NEPA documentation and ESA compliance is required. Reclamation would complete additional environmental analysis and documentation prior to providing contractual approvals for the transfer of water provided under CVP Settlement, Water Service, or Repayment Contracts or requiring conveyance through federal facilities.

Transfers of post-1914 water rights require approval of the State Water Board. Transfers may be temporary, either short-term (one year or less) or long-term (more than one year), or permanent. The Water Code provides for the expedited processing of short-term transfers of one year or less (see Water Code section 1725-1729 and 1435). Section 1729 exempts the short-term transfer from CEQA, and provides an alternative method for considering potential impacts to other water users as well as environmental impacts as part of the SWRCB's transfer processing. The State Water Board's regulations require the transfer applicant to request consultation with CDFW and the appropriate Regional Water Quality Control Board regarding the potential effects of the proposed changes on water quality, fish, wildlife, and other instream beneficial uses, and provide any comments received from those agencies to the State Water Board. The board must find that the transfer will neither injure any legal user of the water nor result in "unreasonable" effects on fish or wildlife or other instream beneficial uses. There is no expedited federal environmental process for short-term transfers. If a federal action is required, compliance with NEPA and ESA would be required.

There is no CEQA exemption for long-term transfers. Long-term transfers also must comply with any CEQA requirements in addition to the requirements outlined above.

The Delta Stewardship Plan exempts temporary water transfers of up to one year in duration through December 31, 2016 from the Delta Plan consistency certification process. The Council contemplates that any extension beyond that date would be based upon the Department of Water Resources and the State Water Resources Control Board's participation with stakeholders to identify and implement transfer measures, as recommended in the Delta Plan's Water Resources Recommendation Number 15. The Plan also requires negotiations for certain SWP and CVP transfers to be carried out publically, consistent with SWP and CVP requirements. Certain transfers may be required to be certified as consistent with the Delta Plan adopted by the Delta Stewardship Council and its implementing regulations.

Any transfers conveyed through BDCP facilities will need to satisfy all of the applicable requirements in force at the time of the transfer's approval. This EIS/EIR does not comprise the CEQA/NEPA coverage required for any specific transfer approval. Rather, it provides an analysis of how transfers relate to the operation of BDCP facilities and covers the movement of water once it has been brought to the Delta through transfers and other types of transactions. Any future water transfers will require separate approvals, including separate coverage of any upstream source area impacts, as outlined above. Appendix 1E provides more information on the types of water transfers in California, their recent history, and the general regulatory setting for transfers.

Revised Water Quality Control Plan (2006)

The State Water Board undertook a proceeding under its water quality authority to amend the Bay-Delta Plan adopted in 1978 and amended in 1991 and in 1995. Prior to commencing this proceeding, the State Water Board conducted a series of workshops in 2004 and 2005 to receive information on specific topics addressed in the Bay-Delta Plan.

The State Water Board adopted a revised Bay-Delta Plan on December 13, 2006. There were no changes to the Beneficial Uses from the 1995 Plan to the 2006 Plan, nor were any new water quality objectives adopted in the 2006 Plan. A number of changes were made simply for readability. Consistency changes were also made to assure that sections of the Plan reflected the current physical condition or current regulation. The State Water Board continues to hold workshops and receive information regarding Pelagic Organism Decline (POD), climate change, and San Joaquin salinity and flows, and will coordinate updates of the Bay-Delta Plan with ongoing development of the comprehensive Salinity Management Plan.

California Endangered Species Act (CESA) 2080.1 Consistency Determination

In 2009 CDFW issued DWR an incidental take permit (ITP) for the on-going and long-term operation of SWP existing facilities in the Sacramento-San Joaquin Delta for the protection of longfin smelt. CDFW also issued DWR consistency determinations for the NMFS BiOp and USFWS BiOp for the continued operation of the SWP and other water diversion, storage and transport related actions that are described in the BiOps. CDFW determined that the BiOps, including the RPA requirements and related incidental take statement, are consistent with CESA because the mitigation measures meet the conditions set forth in Fish and Wildlife Code section 2081 for CDFW to authorize incidental take of CESA species.

SWP Operations Agreements

In addition to operational requirements of the federal and state governments, SWP is operated in accordance with contractual agreements, including the Monterey Agreement and Suisun Marsh Preservation Agreement.

Suisun Marsh Preservation Agreement

Since the early 1970s, the California Legislature, State Water Board, Reclamation, CDFW, Suisun Resource Conservation District, DWR, and other agencies have worked to preserve beneficial uses of Suisun Marsh. In 1987, the SMPA was signed by DWR, Reclamation, CDFW, and Suisun Resource Conservation District. The agreement contains provisions for DWR and Reclamation to mitigate the effects on Suisun Marsh channel water salinity from SWP and CVP operations and other upstream diversions, defines methods and obligations for DWR and Reclamation to meet water supply and salinity standards, sets a timeline for implementing the Plan of Protection, and delineates monitoring and mitigation requirements. The SMPA also includes provisions to recognize water uses in Suisun Marsh and improve wildlife habitat within the marsh.

The requirements of SMPA are recognized in Decision 1641. The two primary physical mechanisms for meeting salinity standards set forth in Decision 1641 and the SMPA include the implementation and operation of physical facilities in the marsh and management of Delta outflow. The physical facilities include the Suisun Marsh Salinity Control Gates on Montezuma Slough (initiated in 1988) to restrict high-salinity flows from Grizzly Bay into Montezuma Slough during incoming tides, and to retain low-salinity water and the Roaring River Distribution System and Morrow Island Distribution System (constructed in 1979 and 1980) to provide low-salinity water to a portion of the Suisun Marsh wetlands.

The Suisun Resource Conservation District, Reclamation, USFWS, DWR, and CDFW prepared the Habitat Management, Preservation, and Restoration Plan for the Suisun Marsh (Suisun Marsh Plan) and Programmatic EIS/EIR to develop, analyze, and evaluate potential effects of various actions in the Suisun Marsh. The actions are intended to preserve and enhance managed seasonal wetlands, implement a comprehensive levee protection/improvement program, and protect ecosystem and drinking water quality while restoring habitat for tidal marsh-dependent sensitive species. The Final

EIS/EIR was issued in December 2011. The EIR/EIS is programmatic and considered restoration of 700 to 9,000 acres of tidal marsh with 42,000 to 52,000 acres of managed wetlands.

California Safe Drinking Water Act

In 1976, California enacted its own Safe Drinking Water Act, requiring the Department of Public Health Services to regulate drinking water, including setting and enforcing federal and state drinking water standards, administering water quality testing programs, and administering permits for public water system operations. The Federal Safe Drinking Water Act allows the State to enforce its own standards in lieu of the federal standards so long as they are at least as protective as the federal standards. Substantial amendments to the California Act in 1989 incorporated the new Federal Safe Drinking Water Act requirements into California law, provided for the State to set more stringent standards, and recommended public health levels for contaminants. As a result, SWP and CVP operations may be affected in the future to reduce potential for high contaminant concentrations as related to reservoir releases, Delta exports, and salinity management actions.

5.2.3 Regional and Local Plans, Policies, and Regulations

Surface water is regulated at the local level (counties and cities) through the general plans and county codes (water-specific ordinances). Most county general plans in the state provide goals and policies related to water service and water resources. For example, the Contra Costa County general plan includes the following provisions: assurance of potable water availability to residents; development of locally controlled water supplies to meet growth; conservation of water resources; flood control and flooding prevention; assurance of adequate long-term supply of water for domestic purposes as well as fishing, agricultural, and industrial uses; maintenance of ecology and hydrology of streams, creeks, and other natural waterways; and enhancement of opportunities for public accessibility and recreational use.

5.3 Environmental Consequences

5.3.1 Methods for Analysis

The water supply analysis addresses changes to water supply to SWP and CVP water users in the Delta region, upstream of the Delta Region, and Export Service Areas due to implementation of BDCP conveyance facilities (CM1) and other conservation measures, specifically tidal marsh habitat restoration (CM4). The alternatives would modify the operations of the SWP and CVP facilities but would not modify the operations of water resources facilities owned and/or operated by other water rights holders. Therefore, the water supply analysis addresses impacts to DWR, Reclamation, and SWP and CVP contractors, as opposed to other water rights holders, as the BDCP does not include any regulatory actions that would affect any such water rights holders. Consistent with previous modeling analyses conducted by DWR and Reclamation, including the 2008 Biological Assessment on the Continued Long-Term Operations of the Central Valley Project and State Water Project, the modeling analyses presented in this section assumed that the SWP and CVP were solely responsible for providing any needed water for BDCP implementation.

The water supply analysis was conducted using the CALSIM II model. A brief overview of the modeling tools and outputs is provided in Section 4.3, *Overview of Tools, Analytical Methods, and Applications*, and a full description of the tools is included in Appendix 5A, *BDCP EIR/S Modeling*.

CALSIM II is a reservoir-river basin planning model developed by DWR and Reclamation to simulate the operation of the SWP and CVP over a range of different hydrologic conditions. CALSIM II allows for specification and achievement of user-specified allocation targets, or goals. CALSIM II is the best available planning model for the SWP and CVP system operations and has been used in previous system-wide evaluations of SWP and CVP operations (U.S. Bureau of Reclamation, 2004, 2008a). Inputs to CALSIM II include water diversion requirements (demands), stream accretions and depletions, reservoir inflows, irrigation efficiencies, and parameters to calculate return flows, non-recoverable losses and groundwater operations. Sacramento Valley and tributary rim basin hydrologies use an adjusted historical sequence of monthly stream flows over an 82-year period (1922 to 2003) to represent a sequence of flows at a future level of development. Adjustments to historic water supplies are imposed based on future land use conditions and historical meteorological and hydrologic conditions. The resulting hydrology represents the water supply available from Central Valley streams to the CVP and SWP at a future level of development. CALSIM II produces outputs for river flows and diversions, reservoir storage, Delta flows and exports, Delta inflow and outflow, Deliveries to project and non-project users, and controls on project operations.

The results of Alternatives simulations are compared to CEQA Existing Conditions simulation and to the NEPA No Action Alternative simulation to assess potential effects on the SWP and CVP water supply availability.

Under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, CALSIM II utilizes a series of operating rules to reach a solution to allow for the continuation of the simulation. It is recognized that these operating rules are a simplified version of the very complex decision processes that SWP and CVP operators would use in actual extreme conditions. Therefore, model results and potential changes under these extreme conditions should be evaluated on a comparative basis between alternatives and are an approximation of extreme operational conditions.

As an example, CALSIM II model results show simulated occurrences of extremely low storage conditions at CVP and SWP reservoirs during critical drought periods when storage is at dead pool levels at or below the elevation of the lowest level outlet. Simulated occurrences of reservoir storage conditions at dead pool levels may occur coincidentally with simulated impacts that are determined to be potentially significant. When reservoir storage is at dead pool levels, there may be instances in which flow conditions fall short of minimum flow criteria, salinity conditions may exceed salinity standards, diversion conditions fall short of allocated diversion amounts, and operating agreements are not met.

5.3.1.1 Quantitative Analysis of SWP and CVP Water Supply Impacts

SWP and CVP water supply allocations and the ability to divert from the south Delta intakes are determined in accordance with federal and state regulations, as described in Section 5.2, *Regulatory Setting*, and Appendix 5A, *BDCP EIR/S Modeling*. Factors that affect SWP and CVP water supply availability include SWP and CVP reservoir storage and Delta outflow requirements. SWP and CVP water supply allocations are calculated based upon current year hydrologic conditions and resultant reservoir storage. Overall, there are many factors that are considered in the determination of

SWP/CVP deliveries and exports. However, the primary factors for this analysis are considered to be Delta outflow requirements and SWP/CVP reservoir storage along with conveyance and regulatory export requirements.

Delta Outflow

Criteria for Delta outflow into San Francisco Bay included in Water Rights Decision 1641 and USFWS and NMFS BiOps, and required by specific requirements of each alternative affect water supply availability for SWP and CVP water users located north and south of the Delta. Water required for Delta outflow must flow into San Francisco Bay to improve water quality and conditions for aquatic resources, as described in Chapter 8, *Water Quality*, and Chapter 11, *Fish and Aquatic Resources*. Because the water must flow into San Francisco Bay to meet the seasonal flow and volume requirements, water allocated for Delta outflow is not available for SWP and CVP water users in the Export Service Areas and may result in limited availability for SWP and CVP water users in the Delta and upstream of the Delta.

Delta outflow requirements also are considered in the determination of the ability to divert water at the SWP and CVP south Delta intakes to minimize reverse flow conditions. Reverse flow conditions in Old and Middle Rivers occur when exports exceed the amount of inflow from the San Joaquin River. Limiting reverse flows in Old and Middle Rivers reduces fish exposure and entrainment at the south Delta intakes.

SWP and CVP Reservoir Storage Upstream of the Delta

The ability to release water from storage to make available to SWP and CVP water users is dependent upon the capability of the reservoir to store adequate water to meet: 1) instream releases, especially with cold water to protect aquatic resources, and 2) Delta outflow requirements, including flows to maintain freshwater conditions in the western Delta (as described in Chapter 8, *Water Quality*).

SWP and CVP Exports and Deliveries

SWP and CVP water supply availability is evaluated in this chapter as SWP/CVP exports into the Export Service Areas and SWP/CVP deliveries throughout the system. Water deliveries downstream of San Luis Reservoir are not necessarily the same volume as Delta exports because portions of the exported water are stored in San Luis Reservoir.

As the reader will see, the model results for CVP Settlement, Refuge, and Exchange Contractors and SWP Feather River Service Area (FRSA) Contractors are complex. Deliveries to CVP Settlement, Refuge, and Exchange Contractors and SWP FRSA contractors are shown only for dry and critical water year types because those are the only years in which allocations for these contractors may be less than 100%. Deliveries to these contractors may be reduced in these instances because of dead pool storage. In the modeling, the CVP water contractors receive their full contract amounts in water years that are classified as Shasta Non-Critical (based on the hydrologic Shasta Index). In Shasta Critical water years (there are nine occurrences in the 82 years simulated under current climate conditions), these contractors receive 75% of their full contract amounts. The model meets these deliveries unless the model shows it is infeasible due to storages being near dead pool. Hence, deliveries reported for these contractors will include nine normally reduced-allocation years and may include additional reductions (either in Shasta Critical years or other years) due to the simulated near dead pool storage conditions.[15]

[15] As described in Section 5.1.2.1 under "Water Demands-Delta Mendota Canal and San Luis Unit", CVP Exchange contractors agreed not to exercise their senior rights to water in the San Joaquin River for a CVP water supply from

Similarly, in the modeling, FRSA water contractors receive their full contract amounts in water years that are classified as Feather River Non-Critical (based on the hydrologic Feather River Index). In Feather River Critical water years (there are six occurrences in the 82 years simulated under current climate conditions), these contractors receive 50% of their full contract amounts per year. The model meets these deliveries unless the model shows it is infeasible due to storages being near dead pool. Hence, deliveries reported for these contractors will include six normally reduced-allocation years and may include additional reductions (either in Feather River Critical years or other years) due to the simulated near dead pool storage conditions.

When reporting changes in CVP Settlement, Refuge, and Exchange Contractors and SWP FRSA contractors, average deliveries are provided for the combination of the SWRCB D-1641 40-30-30 Dry and Critical years for the period of October 1921–September 2003. These years provide a consistent set of years that cover all the Shasta-critical and Feather River critical years under current and future climate conditions; as well as a consistent reporting of results in dry and critical years for all SWP and CVP water contractors (as shown in Appendix 5A, *BDCP EIR/S Modeling*).

Despite these detailed model inputs and assumptions, the model will still sometimes show in very dry years dead pool conditions that appear to prevent Reclamation and DWR from meeting their contractual obligations to these contractors[16]. Such model results are anomalies that reflect the inability of the model to make real-time policy decisions under extreme circumstances, as the actual (human) operators must do. Thus, any reductions simulated due to reservoir storage conditions being near dead pool for these types of delivery should only be considered an indicator of stressed water supply conditions under that Alternative, and should not necessarily be understood to reflect literally what would occur in the future. In actual future operations, as has always been the case in the past, the project operators would work in real time to satisfy legal and contractual obligations given then current conditions and hydrologic constraints.

Basis for Quantification of SWP and CVP Exports and Deliveries

For each alternative, descriptions of changes in Delta outflow and upstream SWP/CVP reservoir storage are presented to provide a basis for understanding of the changes in SWP/CVP exports and deliveries. However, no specific environmental consequences/impact assessment results are presented for changes in Delta outflow and SWP/CVP upstream reservoir storage in this chapter because the environmental effects of these changes under CEQA and NEPA are not considered as water supply effects or impacts. Changes in Delta outflow and SWP/CVP upstream reservoir storage are more related to water quality (see Chapter 8, *Water Quality*), conditions for fisheries (see Chapter 11, *Fish and Aquatic Resources*), recreation (see Chapter 15, *Recreation*), and hydroelectric

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the Delta. Although these contractors have the option of exercising their senior water rights in the event that deliveries from Delta could not be made, this possibility is not included in the model because it is assumed to occur only under extreme conditions, and as mentioned in this paragraph, real time policy decisions would be made to avoid such conditions. If these extreme conditions did occur and Delta water was not available for CVP Exchange contractors, then CVP Exchange contractors could exercise their senior water rights and receive water from Friant Dam, which in turn could have an effect on Friant water users.

[16] As mentioned in Section 5.3.1, BDCP does not include any regulatory actions that would affect any water rights holders. Therefore deliveries to senior water rights holders (pre-1914) are not discussed in this chapter and are not included in discussion of model limitations in this section, although they have the utmost priority in receiving surface water supplies.

generation potential (see Chapter 21, *Energy Resources*). Specific impacts analysis and mitigation measures are provided in those chapters.

The analysis for changes in Delta exports and SWP/CVP water deliveries compares simulated water supply conditions (based upon CALSIM II results) in the following manner.

- Existing conditions (without sea level rise or climate change [i.e., effects on precipitation and snowpack]) and the No Action Alternative (with sea level rise and climate change that would occur at late long-term [LLT] around Year 2060).
- Existing conditions (without sea level rise or climate change) and alternatives (with sea level rise and climate change that would occur at LLT around Year 2060).
- No Action Alternative (with sea level rise and climate change that would occur at LLT around Year 2060) and alternatives (with sea level rise and climate change that would occur at LLT around Year 2060).

The results of the comparison of Existing Conditions to the No Action Alternative and the alternatives reflect differences in in SWP/CVP surface water supply availability resulting from SWP/CVP operations and sea level rise and climate change considered for each alternative and other changes described in Section 5.3.3.1.

The results of the comparison of No Action Alternative to the alternatives reflect differences in water supply conditions due to the difference in SWP/CVP surface water supply availability due to the changes in SWP/CVP operations under the alternative.

In noting effects under different SWP/CVP operational scenarios under LLT around Year 2060 conditions, readers should be aware that some of the differences between those anticipated future conditions and Existing Conditions for CEQA are solely attributable to sea level rise and climate change, and not to the operational scenarios themselves. Many of the various figures in this chapter depicting differences between action scenarios under LLT conditions and the CEQA Existing Conditions may therefore seem to exaggerate the effects of proposed operational changes. In these figures, some portion of the environmental changes depicted are solely attributable to sea level rise and climate change (i.e., anticipated reductions in snowfall and effects on precipitation generally).

Changes due to Sea Level Rise

As sea level rise occurs, salinity would increase in the western and central Delta. The No Action Alternative and all of the alternatives include criteria to maintain freshwater in the western Delta in the spring, and the No Action Alternative and some of the alternatives include criteria to maintain Fall X2 at the compliance points specified in the 2008 FWS BiOp in wet and above normal years. There were no changes in the maximum allowable salinity standards (and the related extent of freshwater in the western Delta) in the No Action Alternative or alternatives resulting from sea level rise. As sea level rise occurs, more water would need to be released from the SWP and CVP reservoirs to avoidance exceeding Delta maximum allowable salinity standards, therefore, less water would remain in storage at the end of September and less water would be available for SWP and CVP water supplies both upstream and downstream of the Delta.

Increased salinity in the west Delta near Rock Slough with sea level rise also would change the ability to divert water from the south Delta intakes sometimes in the fall months. If the salinity is greater than the allowed criteria, as described in Chapter 8, *Water Quality*, operations of south Delta intakes would be limited and water is released from the SWP and CVP reservoirs to maintain fresh water conditions at Rock Slough. Therefore, less water would be available for SWP and CVP water supplies downstream of the Delta.

Effects due to Climate Change

In the future, changes in climate are assumed to increase the amount of rainfall and decrease the amount of snow that would occur in the Sacramento and San Joaquin rivers watersheds. Therefore, peak runoff would be more likely in the late winter and early spring and runoff during the late spring and summer would be reduced under future climate conditions as compared to current climate conditions. These conditions could result in higher flood potential in the winter and early spring months.

Reduction in runoff from snowmelt in the summer months would reduce the ability of the SWP and CVP reservoirs to refill as water is released for downstream and Delta requirements and exports. Decreased storage levels, combined with warmer ambient air temperatures, would raise average water temperatures within reservoirs, contributing to warmer temperatures in the rivers and streams below the dams impounding the reservoirs, and making it more difficult to meet temperature requirements for cold-water fishery resources. The reduction in reservoir storage would also reduce water supply availability for SWP and CVP water users both upstream and downstream of the Delta.

Reduction in runoff in the summer months also would reduce instream flows in the Sacramento and San Joaquin River. Operations of the south Delta intakes under the No Action Alternative and alternatives are largely dependent on Delta inflows. If there is less inflow into the Delta, less water can likely be exported by the SWP and CVP.

Shifts in precipitation and runoff patterns also cause changes in water supply indices that are used for allocation of water supplies such as the Shasta Index and the Feather River Index discussed above. For example, the number of critically dry years based on Feather River Index increased from six in Existing Conditions simulated with current climate conditions, to nine in the No Action Alternative and the Alternatives simulated with the 2060 climate conditions at late long-term [LLT] around Year 2060. This reclassification may have a sizable effect on reported dry and critical year average differences when compared to the Existing Conditions. For Shasta Index, the number of Shasta-critical years did not increase; however, there was a change in actual modeled years that were found to be critical. Similar effects were observed on other indices as well.

The ability to operate the south Delta intakes also would be limited with less inflow from the San Joaquin River. The San Joaquin River inflows amongst other factors, contribute to the Old and Middle River flows, and operations of the south Delta intakes can lead to negative Old and Middle River flows. The No Action Alternative and the alternatives that rely upon south Delta intakes operate with criteria to minimize reverse flows. If those criteria cannot be achieved, operations of the south Delta intakes could be limited and less water would be available for export.

Describing Changes due to Sea Level Rise and Climate Change as Compared to Changes due to New Facilities and Operations

In general, the incremental differences in SWP/CVP water supply conditions under the No Action Alternative due to sea level rise and climate change are similar or greater than the differences in SWP/CVP water supply conditions under the alternatives due to changes in proposed operational scenarios. As is the case throughout this document, effects are analyzed in this chapter under both

NEPA and CEQA, with the NEPA analysis being based on a comparison of the effects of action alternatives against a future No Action condition and the CEQA analysis being based on a comparison of these effects against Existing Conditions. One consequence of the different approaches is the manner in which sea level rise and climate change are reflected in the respective impact conclusions under the two sets of laws. Under NEPA, the effects of sea level rise and climate change are evident both in the future condition and in the effects of the action alternatives. Under CEQA, in contrast, the absence of sea level rise and climate change in Existing Conditions results in model-generated impact conclusions that include the impacts of sea level rise and climate change with the effects of the action alternatives. As a consequence, the CEQA conclusions in many instances either overstate the effects of the action alternatives or suggest significant effects that are largely attributable to sea level rise and climate change, and not to the action alternatives.

In both sets of analyses, the Lead Agencies have relied on computer models that represent best available science; however, any predictions of conditions 50 years from the present are inherently limited and reflect a large degree of speculation. In the interest of informing the public of what DWR believes to be the reasonably foreseeable impacts of the action alternatives, DWR has focused primarily on the contribution of the action alternatives, as opposed to the impacts of sea level rise and climate change, in assessing the significance of the impacts of these action alternatives. The opposite approach, which would treat the impacts of sea level rise and climate change as though they were impacts of the action alternatives, would overestimate or underestimate the effects of the action alternatives depending on the resource. The assessment approach has the effect of highlighting the substantial nature of the consequences of sea level rise and climate change on California's water system.

For each alternative, the following impact assessment comparisons are presented for the quantitative analyses of Delta exports and SWP and CVP deliveries:

- Comparison of each alternative (at LLT) to Existing Conditions (the CEQA baseline), which will result in changes in SWP/CVP water supply conditions that are caused by three factors: sea level rise, climate change, and implementation of the alternative. It is not possible to specifically define the exact extent of the changes due to implementation of the alternative using the model simulation results presented in this chapter. Thus, the precise contributions of sea level rise and climate change to the total differences between Existing Conditions and LLT conditions under each alternative cannot be isolated.
- Comparison of each alternative (at LLT) to No Action Alternative (at LLT) to indicate the general extent of changes in SWP/CVP water supply conditions due to implementation of the alternative. Because sea level rise and climate change are reflected in each action alternative and in the No Action Alternative, this comparison reflects the extent of changes in SWP/CVP water supplies attributable to the differences in operational scenarios amongst the different action alternatives.

If sea level rise and climate change do not occur or occur differently than modeled for these analyses, water supply conditions under the alternatives will be different from the results presented in this section. Time will tell whether current predictions of conditions in 2060, though based on the best science currently available, will prove to be too optimistic or too pessimistic. For a thorough discussion of the methodologies used to predict sea level rise and climate change as of 2060, see Chapter 29, *Climate Change*, and Appendix 5A, *Modeling Methodology*.

Effects on Water Transfers

SWP and CVP deliveries vary with hydrology, upstream consumptive use of water, environmental and regulatory constraints, and a variety of additional factors. A comparison of the predicted future deliveries under the No Action Alternative to the existing condition shows a decrease in SWP and CVP deliveries into the future. These delivery reductions would be mainly due to a combination of effects of sea level rise and climate change, increased future upstream and in-delta water demand or in-basin consumptive use of water (having priority over SWP and CVP rights) and implementation of the Fall X2 standard (see Appendix 5A, *BDCP EIR/S Modeling Technical Appendix*). It is possible that the delivery reductions will be less than predicted in the CALSIM II modeling given that the increase assumed for in-basin consumptive use may not occur to the extent included in the analysis. However, it is still expected that there will be a decline in SWP and CVP deliveries into the future. The demand for supplemental supplies to help offset that decline will tend to increase the demand for water transfers even after the implementation of water conservation measures.

Historical information reveals certain patterns of water transfers as related to hydrology and project deliveries. Water transfer demand and completed transfers have increased over time as consumptive use of water in California has increased and export of CVP and SWP water from the Delta has become increasingly restricted. The increase in demand for transfer water is particularly evident in drier year types with lower SWP and CVP allocations.

The CVP and SWP only account for water transfers released during balanced conditions, when the projects are releasing stored water to maintain Delta standards. During excess conditions, there is more Delta inflow than needed to meet Delta standards and support targeted Delta export pumping. Under excess conditions, any new transfer water released to the Delta for export would merely increase Delta outflow, and would not be accounted as delivered transfer water because it could not be delivered to any buyers downstream of the export pumps. Transfer water released during balanced conditions can allow the projects to either reduce their storage releases or increase exports. The transfer water benefit is then accounted for as passing to the downstream buyers when it is exported.

Typically there are few purchases of transfer water upstream of the Delta in the wetter year types to supplement project supplies, although there may be such purchases for either environmental purposes and/or for storage in a water bank. Little demand exists in wetter years due to greater SWP and CVP deliveries and availability of alternative local supplies. For any such transfers, there is a material risk that the water cannot be exported, either because: the Delta could be in excess conditions through part or all the summer, limiting or precluding the accounting of any transfers; the CVP and SWP are using all available pumping capacity to move project supplies; or the wetter year types have suppressed local demand, increased local supplies, and project allocations are adequate.

Some water agencies in the export service area have suffered from chronic water supply reductions, especially the San Luis and Delta-Mendota Water Authority, representing numerous CVP contractors in the export service area. The Authority has arranged for a number of transfers to augment their annual supply, and has focused on areas south of the Delta to reduce reliance on the Delta export pumps to move transfer water except in the driest year types. These transfers are described in Appendix 5C, in the section entitled Federal Water Purchase Programs in California, and are relevant to the assumptions used for the analysis of the Authority's estimated demand for cross-Delta transfers in times of low allocations.

In the drier years, the San Luis and Delta-Mendota Water Authority actively seeks cross Delta transfers in addition to its participation in the Yuba Accord dry year water purchase program. In 2001, it participated in a forbearance program whereby CVP contractors upstream of the Delta did not take certain CVP supplies, allowing them to flow to the Delta and augment CVP exports to the Authority and others.

The SWP contractors have been active participants in water transfers as well in the drier years. DWR has also conducted a number of drought water banks and dry year programs to help California water agencies through droughts and dry year sequences.

Table 5-2 illustrates the hydrologic year types, SWP and CVP allocations, and estimated cross-Delta water transfers.

Table 5-2. Cross-Delta Transfer History, 1995-2012

Year	Sacramento River Year Type	San Joaquin River Year Type	SWP Percent Allocation	CVP San Joaquin Ag Percent Allocation	Active Cross-Delta Transfer Program	Cross-Delta Transfers Without EWA, AF	Cross-Delta Transfers With EWA, AF
1995	W	W	100	100	No	0	0
1996	W	W	100	95	No	0	0
1997	W	W	100	90	No	0	0
1998	W	W	100	100	No	0	0
1999	W	AN	100	70	No	0	0
2000	W	AN	90	65	No	0	0
2001	D	D	39	49	Yes	298,806	403,806
2002	D	D	70	70	Yes	22,000	164,143
2003	AN	BN	90	75	EWA Only	0	69,914
2004	BN	D	65	70	EWA Only	0	118,700
2005	BN	W	90	85	No	0	6,044
2006	W	W	100	100	No	0	0
2007	D	C	60	50	EWA Only	0	125,000
2008	C	C	35	40	Yes	169,186	169,186
2009	D	D	40	10	Yes	274,551	274,551
2010	BN	AN	50	45	Yes	264,165	264,165
2011	W	W	80	80	No	0	0
2012	BN	D	65	40	Yes	84,781	84,781

Records of past cross-Delta transfers from 1995-2012 were reviewed to identify the years in which there were spikes in such transfers to estimate the project allocation percentages that tend to stimulate demand for cross-Delta transfers. Table 5-2 illustrates the hydrologic year types, SWP and CVP allocations, and estimated cross-Delta water transfers. The table shows that recent transfer volumes are substantially less than the supplies assumed for purposes of this analysis, namely 600,000 acre-feet up to a possible 1,000,000 acre-feet (Appendix 5C). The lower historical range shown in Table 5-2 above may reflect less severe drought conditions during the 1995-2012 period than historical droughts in the 1930s and late 1980s-early 2000s (and higher allocations during this period than the very low allocation percentages shown in CALSIM II output in some of the drier years in the period of analysis), lack of confidence by buyers to commit to purchases given limited Delta export capacity, further constrained by the current limited transfer “window” of July 1-September 30 without further ESA consultation, and other factors.

If the supply from upstream-of-Delta willing seller sources is less than assumed in this analysis, there would be fewer transfers under all the alternatives, including the existing conditions, but the trends and relative impacts would still be valid. In such a case, the impacts would be conservatively overstated.

Table 5-2 indicates that cross-Delta transfer interest generally accompanies the dry year periods and low allocations. Comparing the years when cross-Delta transfer activity picks up with allocations, and considering Delta export constraints on transfers, SWP demand for cross-Delta transfers increases noticeably at allocations below 50 percent, and CVP demand for cross-Delta transfers increases below 40 percent. Using these approximations, DWR developed estimates of the demand for supplemental supplies necessary to bring the SWP and CVP project deliveries up to the 50 percent and 40 percent levels, respectively, when allocations are less than those values.

The data are shown both with the Environmental Water Account (EWA) program cross-Delta transfers and without. The EWA purchased and transferred water to offset Delta export pumping curtailments, transferring water in every year from 2001-2007 regardless of hydrology (except 2006 when Delta conditions were sufficiently wet that excess conditions prevailed all summer, precluding all cross-Delta transfers). The EWA cross-Delta transfers were larger in the drier years due to the increase in Delta pumping capacity available for transfers. In the wetter year types, the EWA purchased more of its transfer water from south of Delta sources.

The EWA is not considered a reliable indicator of cross-Delta demand by the SWP and CVP because export curtailments occurred in all year types to protect fish, and the source (upstream or downstream of the Delta) of the replacement water was dependent on predicted cross-Delta transfer capacity rather than on contractor demand for supplemental water supplies. Therefore the EWA cross-Delta transfers should not be considered in estimating the likely SWP and CVP allocations that triggered cross-Delta demand in the 1995-2012 period.

The amount of supplemental water necessary to provide SWP and CVP supplies of at least the 50 percent and 40 percent values could exceed 1,500,000 acre-feet in drought years similar to those in the 1930s and the 1990s, based on the analyses of deliveries derived from the CALSIM II modeling output for the 82-year period covered. The focus of this analysis is on the cross-Delta transfer implications of the BDCP alternatives, and therefore an estimate of the potential volume of water that could be transferred across the Delta and the relative frequency of such transfers is required.

The potential cross-Delta transfer volume may be limited by the capacity of the export facilities, regulatory constraints including BDCP permit terms, and by the availability of water for transfer from willing sellers upstream of the Delta. For the purpose of this analysis, two amounts of cross-Delta transfer water have been assumed with respect to the quantity of water that can be purchased from willing sellers upstream of the Delta based on studies prepared for the Biological Assessment on the Continued Long-Term Operations of the Central Valley Project and the State Water Project, experience of DWR and Reclamation in administering dry year water transfer programs and the EWA, and an approximate estimate of water from prior water transfer sellers. The 2008 Biological Assessment assumed 600,000 acre-feet of cross-Delta transfers as a likely amount for consideration in the Biological Opinions. Additionally, the 2008 Biological Assessment also stated at Page 12-39: "Water transfers would increase Delta exports from about 0 to 500,000 acre-feet (af) in the wettest 80 percent of years and potentially more in the driest 20 percent years, and up to 1,000,000 af in the most adverse Critical year water supply conditions."

The analysis in Appendix 5D examines the magnitude and frequency of cross-Delta transfers in the case of 600,000 acre-feet as well as 1,000,000 acre-feet of water being available for transfer in any given year. Appendix 5C provides information on potential sources of transfer water in the areas upstream of the Delta, and Appendix 5D provides tables of relative transfer frequency and magnitude for each BDCP alternative assuming both 600,000 acre-feet and 1,000,000 acre-feet of transfer water could become available.

It should be noted that in the 1991 Drought Water Bank DWR executed contracts for the purchase of 821,000 acre-feet of water. However, 40 percent of that contracted amount was developed through crop idling in the Delta region, and, based on the experience gained in 1991, DWR no longer approves similar transfers. There has been a significant evolution in the understanding of how much water can be made available from various types of transfer such as crop idling or groundwater substitution, as well as potential impacts associated with large scale transfers from a single region.

No allowance is included in the analysis for the multi-year effects of droughts on the upstream-of-Delta transfer water supplies that could be available from willing sellers. Those available supplies are likely to decrease during a multi-year drought. Many potential sellers will also experience water shortages of their own as a result of multi-year droughts due to the imposition of shortages under SWP and CVP settlement contracts or reductions in surplus reservoir storage. Groundwater substitution programs can generally be operated for a number of consecutive years, as is the case under the Yuba Accord, but after several years of a drought, increased in-basin demands may result in conditions that would limit the opportunities for additional groundwater pumping for water transfers.

Because this analysis does not attempt to quantify the reductions in supplies in the later years of a multi-year drought, the estimate of cross-Delta transfers is conservatively overstated in those types of events. Historically, such droughts occurred in the 1929-1935 period and again in the 1987-1992 period. Therefore the cross-Delta transfers during the later years of those drought periods would be less than the 600,000 acre-foot and 1,000,000 acre-foot volumes used for this analysis, but no quantification of how the supply would diminish during droughts has been made. The estimate of either 600,000 acre-feet or 1,000,000 acre-feet being available in consecutive dry years may overstate the potential volume of cross-Delta transfers in such conditions.

The estimates of cross-Delta transfer demand assume that the SWP and CVP contractors would attempt to replace approximately half of the supply deficits below the 50 percent and 40 percent allocation thresholds respectively with cross-Delta transfers, up to the assumed maximum available supply.

The assumption that half of the supply deficits would be sought from cross-Delta transfers for each project is based on similar but separate considerations for the SWP and the CVP. Many of the SWP contractors, particularly those with the highest contract amounts (e.g., MWDSC, KCWA, SCVWD) have extensive storage and/or banking arrangements. Diamond Valley Lake and Lake Mead (MWDSC) and the Kern County area water banks (multiple banking contractors) are examples. This analysis assumes that the SWP contractors, on average, will draw on sources of stored water and limit cross-Delta transfers to no more than 50 percent of the supplemental demand, and no more than their proportion of the available upstream-of-Delta supply available from willing sellers as shared with the CVP contractors.

For the CVP contractors, the Authority has arranged numerous transfer programs that are confined to the San Joaquin Valley to increase supply reliability and minimize the risk of depending on cross-Delta transfers. However, because the Authority has less banking and storage capacity relative to its contract amount as compared to the SWP contractors as a group, it still requires cross-Delta transfers to meet the 40 percent equivalent allocation in a low allocation year. This analysis assumes that the CVP contractors, on average, will draw on their limited sources of stored water and their San Joaquin Valley transfer arrangements, and will limit cross-Delta transfers to no more than 50 percent of the supplemental demand, and no more than their proportion of the available upstream-of-Delta supply as shared with the SWP contractors. A more detailed discussion of some of the San Joaquin Valley transfers the Authority draws upon to meet some of its need is presented in Appendix 5C in the section entitled "Federal Water Purchase Programs in California."

In periods where allocations would be below the thresholds for two and three consecutive years, the demand for cross-Delta transfers (but not the supply) would be augmented slightly to help address multi-year deficiencies with transfers. For purposes of the analysis, these demand estimates are set at the 600,000 acre-feet and 1,000,000 acre-feet supply assumptions, respectively, and the supply is assumed to be shared equally between the SWP and CVP in the analysis regardless of any export constraints. Tables of transfer amounts reflecting both values for available supply are presented in Appendix 5D.

The analysis therefore presents estimates of two different parameters: an estimate of the supplemental supply required to bring SWP and CVP project supplies up to the 50 percent and 40 percent equivalent allocation amounts, and an estimate of cross-Delta water transfers that is assumed to be sought from willing sellers of 600,000 acre-feet (with values for 1,000,000 acre-feet presented in Appendix 5D) in any one year to offset about 50 percent of that demand for supplemental supplies.

The analyses consider only the SWP Table A allocation amounts as reported in the CALSIM II output, and the south-of-Delta CVP agricultural service area deliveries (export service area), also as reported in the CALSIM II output. The SWP values are converted to percentage allocations based on the Table A value of 4,164,000 acre-feet, reflecting the approximate maximum in the CALSIM II output, which is slightly greater than the current 4,156,336 acre-feet of contractual Table A for the 2021-2035 period. The CVP values are converted to percentage allocations based on the contract supply amount of 1,965,000 acre-feet for the agricultural water service contractors located south of the Delta as reported by Reclamation in its periodic allocation press releases.

The computations exclude SWP Article 21 water, Article 56 water, and other water categories available under the SWP long-term water supply contracts. Article 21 water is primarily available in the wetter year types, and is not available to offset dry year shortages unless stored the contractors' facilities in the wetter periods for later use. Article 56 water stored outside of an SWP contractor's service area and carryover water can be available to supplement supplies and help offset part or all of the delivery shortages implied by low Table A allocations for some contractors. The availability of these supplies is not readily predictable within the time frames of the analysis, and no attempt is made to quantify them. Nevertheless, those supplies can materially reduce transfer demand, especially at the onset of a dry period. Some contractors do not have storage programs and are more dependent on a consistent annual supply, and their demand for transfer water will develop more rapidly with lower allocations.

The CVP municipal and industrial contractors located south of the Delta are not included in the analysis because they are subject to much less severe reductions than the agricultural contractors, and their volume is about 8 percent of the agricultural contract amount. While those shortages can still trigger cross-Delta transfer demands, the total volume of transfer demands as shown in the analysis exceeds the available cross-Delta supply such that the inclusion of these M&I demand shortages would not alter the conclusions of the analysis.

The analysis has not been limited or constrained by cross-Delta transfer capacity, although such constraints are currently a factor in the export of transfers, as discussed in Section 5.2.2.2. In the future, transfer supplies could be moved in the BDCP facilities or across the Delta, depending on operational and regulatory constraints, and transfer capacity is likely to limit actual cross-Delta transfers at times. However, this analysis does not place any such limits on conveyance capacity through the in-Delta channels or through the BDCP facilities at this time.

The results of the analysis are presented in terms of the number of years in which demand for cross-Delta transfers would likely be generated under these assumptions in comparison to the existing conditions and No Action Alternative and the estimated average annual transfer volume generated by the estimated demand in terms of a percentage increase or decrease relative to the existing conditions and the No Action Alternative.

Potential environmental impacts of water transfers are discussed in Chapter 30, Section 30.3.6.

5.3.1.2 Project- and Program-Level Components

For this analysis, changes in SWP and CVP water supply are evaluated at a project level of detail. It should be noted that SWP/CVP water supply operations are affected both by specific operations criteria identified for each alternative, which are addressed on a project level basis in this EIR/EIS, and by assumptions regarding the location and extent of tidal marsh restoration for each alternative, which are identified only at a programmatic level in this document. Therefore, long-term results of SWP/CVP operations may be different than described due to changes in location and extent of tidal marsh restoration.

5.3.2 Determination of Effects

NEPA is concerned with effects on the "human environment." Under the definition of this term found in section 1508.14 of the NEPA regulations adopted by the President's Council on Environmental Quality, "'[h]uman environment' shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. (See the definition of 'effects' (Sec. 1508.8).) This means that economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment.

The CEQA Conclusions presented in this EIR/EIS follow the requirements of CEQA and the State CEQA Guidelines. Under CEQA, an EIR must identify significant effects on the "environment" (Public Resources Code, section 21002(a)). Unlike the broader definition of "human environment" found in the NEPA regulations, the "environment" is defined under CEQA more narrowly as "the physical conditions which exist within the area which will be affected by a proposed project, including land, air, water, minerals, flora, fauna, noise, objects of historic or aesthetic significance" (Public Resources Code, section 21060.5. Changes in SWP/CVP exports or deliveries are not specifically included in the physical conditions but could be considered as part of economic or social changes. Under CEQA, however, economic or social changes that a project could cause "shall not be treated as significant effects on the environment" (State CEQA Guidelines, section 15131[a]). The economic or social change, or in this case the change in SWP/CVP exports or deliveries, that a project may cause are not, in and of themselves, significant environmental effects that would require analysis under CEQA. However, the effects of changes to SWP/CVP export or deliveries could be relevant in determining the significance of physical environmental changes, such as changes in decisions by SWP/CVP agricultural water users to convert agricultural land to other uses; or indirect physical changes in the environment, such as the need to develop future water supplies. These types of environmental effects are addressed throughout this EIR/EIS in appropriate chapters. In addition, the Responses to Reduced Delta Water Supplies are discussed in Appendix 5A *BDCP EIR/S Modeling*. This chapter, however, does not consider the significance of changes or mitigation for water supplies that could be related to changes in SWP/CVP exports and deliveries under CEQA.

Under CEQA, the significance of any physical impacts is assessed against a "baseline" reflecting "existing conditions" (State CEQA Guidelines, section 15125[a]). Under NEPA, in contrast, the effects of action alternatives are assessed by comparing them against a future condition that would occur under the No Action Alternative. The NEPA No Action Alternative, which reflects an anticipated future condition in 2060, includes both sea level rise and climate change (changed precipitation patterns), which are also assumed in each of the action alternatives (allowing for comparisons in which those two factors are held constant). The No Action Alternative also assumes, among many other programs, projects, and policies, implementation of most of the required actions under both the December 2008 USFWS BiOp and the June 2009 NMFS BiOp. Because the manner in which some other required actions under those BiOps will be implemented remains uncertain at present, however, these latter required actions were not incorporated, and could not be incorporated, into modeling for the No Action Alternative or for any of the action alternatives. Although it is possible that the implementation of these unmodeled actions over time could alter the resultant magnitude of effects under the implementation of BDCP action alternatives, the analysis contained in this EIR/EIS is intended to take that possibility into account by being conservative with respect to any potential environmental consequences of those required actions that still remain uncertain at present, i.e., the unmodeled required BiOp actions, of course, are intended to improve conditions for fisheries, so that their full implementation over time should contribute to reduced environmental effects and to increased environmental benefits. Not all of the actions from the December 2008 USFWS BiOp and the June 2009 NFMS BiOp included in the No Action Alternative are included in the assumptions of Existing Conditions. (See Appendix 3D).

Examples of required actions not included in the modeling are seasonally inundated floodplain and tidal habitat restoration under NMFS Action I.6.1 and USFWS RPA Component 4. Once they are fully developed and implemented, these actions could alter in-Delta water use, which could affect water supply under certain circumstances. Another example of an unmodeled required action is the creation of Sacramento River Basin salmonid rearing habitat improvements, as envisioned under NMFS Action I.6. Once this action is fully developed and implemented, it could also affect water supply under the No Action Alternative compared to Existing Conditions.

Because the effects of these unmodeled potential future actions should be environmentally beneficial, however, the modeling for the No Action Alternative likely somewhat overstates the effects of both the No Action Alternative and the proposed action alternatives, making the impact analysis conservative in character (meaning that future conditions in 2060 will likely be more environmentally benign than is reflected in the modeling).

5.3.3 Effects and Mitigation Approaches

5.3.3.1 No-Action Alternative

Under the No Action Alternative, the facilities and operations of the SWP and CVP would continue to be similar to Existing Conditions with the following changes.

- Effects of sea level rise and climate change on system operations as discussed in section 5.3.1.1.
- An increase in demands and the buildout of facilities associated with water rights and CVP and SWP contracts of about 443 TAF per year, north of Delta at the future level of development. This is an increase in CVP M&I service contracts (253 TAF per year) and water rights (184 TAF per year) related primarily to urban M&I use, especially in the communities in El Dorado, Placer, and Sacramento Counties.
- An increase in demands associated with SWP contracts, up to full contract amounts, south of Delta at the future level of development. SWP M&I demands, which under the existing level of development vary on hydrologic conditions between 3.0 and 4.1 MAF per year, under the future condition are at maximum contract amounts in all hydrologic conditions. This represents a potential 25% increase on average in south of Delta demands under SWP M&I contracts between existing and future levels of development due to assumed additional development and demographics.
- New urban intake/Delta export facilities:
    - Freeport Regional Water Project (see Appendix 5A, *BDCP EIR/S Modeling* for information on additional EBMUD demand of about 26 TAF/YR on the average with increased demand in dry years)
    - 30 million-gallon-per-day City of Stockton Delta Water Supply Project
    - Delta-Mendota Canal–California Aqueduct Intertie
    - Contra Costa Water District Alternative Intake and 55 TAF/YR increased demand
    - South Bay Aqueduct rehabilitation, to 430 cfs capacity, from the junction with California Aqueduct to Alameda County Flood Control and Water Conservation District Zone 7.
- An increase in supplies for wildlife refuges including Firm Level 2 supplies of about 8 TAF per year at the future level of development. In addition, there is a shift in refuge demands from south to north (24 TAF per year reduction in south of Delta and 32 TAF per year increase in north of Delta).
- Implementation of the Fall X2 RPA action (see Appendix 5A, *BDCP EIR/S Modeling*), which requires maintenance of X2 at specific locations in wet and above normal years in September and October, plus releases in November to augment Delta outflow dependent on hydrology.

- Increased demands for cross-Delta water transfers, with the frequency of such transfers increasing from about 52 percent of years to 68 percent of years, and average annual transfer volume increasing from 146,000 acre-feet to 280,000 acre-feet compared to existing conditions.

A detailed description of the modeling assumptions associated with the No Action Alternative is included in Appendix 5A, *BDCP EIR/S Modeling.*

Ongoing Plans, Policies, and Programs

The programs, plans, and projects included under the No Action Alternative are summarized in Chapter 3, *Description of Alternatives*. Most of the projects would not affect SWP/CVP water supply availability under the No Action Alternative as compared to Existing Conditions. The projects that could affect SWP/CVP water supply availability are summarized in Table 5-3, along with their anticipated effects on water supply.

Table 5-3. Effects on SWP/CVP Water Supply Availability from the Plans, Policies, and Programs for the No Action Alternative as compared to Existing Conditions

Agency	Program/Project	Status	Description of Program/Project	Changes to SWP/CVP Water Supply
Contra Costa Water District, Bureau of Reclamation, and California Department of Water Resources	Middle River Intake and Pump Station (previously known as the Alternative Intake Pump Station)	Project completed and was formally dedicated July 20, 2010	This project includes a potable water intakes and pump station to improve drinking water quality for Contra Costa Water District customers.	No adverse effects on water supply resources are anticipated based upon environmental documentation for this project (Contra Costa Water District 2006).
California Department of Water Resources	Federal Energy Regulatory Commission (FERC) License Renewal for Oroville Project	Draft Water Quality Certification issued December 6, 2010 and comments on Draft received December 10, 2010	The renewed federal license will allow the Oroville Facilities to continue providing hydroelectric power and regulatory compliance with water supply and flood control.	No adverse effects on water supply resources are anticipated based upon environmental documentation for this project (California Department of Water Resources 2008a).
Freeport Regional Water Authority and Bureau of Reclamation	Freeport Regional Water Project	Project was completed late 2010.	Project includes an intake/pumping plant near Freeport on the Sacramento River and a conveyance structure to transport water through Sacramento County to the Folsom South Canal.	No adverse effects on water supply resources are anticipated based upon environmental documentation for this project (Freeport Regional Water Authority 2003).
California Department of Water Resources and Solano County Water Agency	North Bay Aqueduct Alternative Intake Project	Study is ongoing.	This project will construct an alternative intake on the Sacramento River and a new segment of pipeline to connect it to the North Bay Aqueduct system.	No adverse effects on water supplies are anticipated because the total diversions would be similar as the diversions allowed under the existing conditions.

Agency	Program/Project	Status	Description of Program/Project	Changes to SWP/CVP Water Supply
City of Stockton	Delta Water Supply Project (Phase 1 only)	Completed in 2012	This project consists of a new intakes structure and pumping station adjacent to the San Joaquin River; a water treatment plant along Lower Sacramento Road; and water pipelines along Eight Mile, Davis, and Lower Sacramento Roads.	No adverse effects on water supply resources are anticipated based upon environmental documentation for this project (City of Stockton 2005).
Tehama Colusa Canal Authority and Bureau of Reclamation	Red Bluff Diversion Dam Fish Passage Project	Completed in 2012.	Proposed improvements include modifications made to upstream and downstream anadromous fish passage and water delivery to agricultural lands within CVP.	No adverse effects on water supply resources are anticipated based upon environmental documentation for this project (Bureau of Reclamation 2002).
Bureau of Reclamation, California Department of Fish and Wildlife, and Natomas Central Mutual Water Company	American Basin Fish Screen and Habitat Improvement Project	Completed in 2012.	This three-phase project includes consolidation of diversion facilities; removal of decommissioned facilities; aquatic and riparian habitat restoration; and installing fish screens in the Sacramento River. Total project footprint encompasses about 124 acres east of the Yolo Bypass.	No adverse effects on water supply resources are anticipated based upon environmental documentation for this project (Bureau of Reclamation 2008b).
Bureau of Reclamation and San Luis & Delta Mendota Water Authority	Grassland Bypass Project, 2010–2019	Program under development	This project includes development of feasible drainwater treatment technology to meet revised Basin Plan objectives. Please refer to Appendix 3D for further explanation.	No adverse effects on water supply resources are anticipated based upon environmental documentation for this project (USBR and SLDMWA, 2008, 2009).
Bureau of Reclamation	Delta-Mendota Canal/California Aqueduct Intertie	Completed in 2012.	The purpose of the intertie is to better coordinate water delivery operations between the California Aqueduct (state) and the Delta-Mendota Canal (federal) and to provide better pumping capacity for the Jones Pumping Plant. New project facilities include a pipeline and pumping plant.	No adverse effects on water supply resources are anticipated based upon environmental documentation for this project (Bureau of Reclamation 2009).

Agency	Program/Project	Status	Description of Program/Project	Changes to SWP/CVP Water Supply
Zone 7 Water Agency and California Department of Water Resources	South Bay Aqueduct Improvement and Enlargement Project	Completed in 2012.	The project includes construction of a new reservoir and pipelines and canals to increase the capacity of the South Bay Aqueduct.	No adverse effects on water supply resources are anticipated based upon environmental documentation for this project (California Department of Water Resources 2004).
USFWS	2008 Biological Opinion	Ongoing	The Biological Opinion issued by USFWS establishes certain RPAs that affect water supplies.	Operational requirements due to RPA Action IV (Fall X2) implementation in wet and above normal years contained in the federal biological opinions would result in a decrease in the ability of the SWP and CVP to deliver water. This would be an adverse effect.

Model simulation results for the No Action Alternative compared to Existing Conditions are discussed in the following sections and summarized in Tables 5-4 through 5-7.

Change in Delta Outflow

Average annual Delta outflow would increase by 750 TAF (5%) in the No Action Alternative as compared to Existing Conditions. Changes in Delta outflow would result from the seasonal changes in the timing of precipitation and runoff due to climate change, with higher outflows in December through March and lower outflows in April through June, as shown in Figure 5-3. The increase in Delta outflow in September and October in wet and above normal years would be due to increased outflow to meet Fall X2 and because higher outflows are needed to meet Fall X2 requirements as a result of sea level rise and salinity intrusion into the Delta under future 2060 climate conditions. The changes in the timing of seasonal outflows are more prominent in wet years as compared to dry years, as shown in Figures 5-4 and 5-5.

Results for changes in Delta Outflow are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Change in SWP and CVP Reservoir Storage

The exceedance plots in Figures 5-6 through 5-16 show No Action Alternative reservoir end-of–month storage values compared to Existing Conditions. Results for changes in SWP and CVP reservoir storage are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*. The shift in runoff patterns due to climate change would result in less storage in upstream reservoirs in May and September, as shown in Figures 5-6 through 5-16. Storage reductions in May and September are caused by a combination of higher runoff in January and February that cannot be captured due to flood storage limitations, higher releases to meet Fall X2, and lower carryover storage from previous years due to higher releases for Fall X2 in wet and above normal years, and increased system demands by water rights holders, especially in El Dorado, Placer and Sacramento counties.

In comparison to Existing Conditions, there would be a decrease in carryover storage at the end of September for Lake Oroville, Trinity Lake, Shasta Lake, and Folsom Lake in all years. Lake Oroville storage would decrease by 646 TAF (31%) in September average end of month storage. Trinity, Shasta, and Folsom lakes September carryover would decrease by 230 TAF (17%), 481 TAF (18%), and 146 TAF (28%), respectively under No Action Alternative as compared to Existing Conditions. The frequency of Trinity, Shasta, and Folsom Lakes dropping to dead pool storage would increase by about 10% under the No Action Alternative as compared to Existing Conditions. These changes in storage would reduce the ability of the CVP and SWP to meet system water demands and environmental water needs. Adaption measures would need to be implemented on upstream operations to manage coldwater pool storage levels under future sea level rise and climate change conditions. As described in the methods section, model results when storages are at or near dead pool may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

Potential for Abrupt Disruptions of South of Delta Water Supplies

The levee system in the Delta is composed of approximately 1,115 miles of levees in the Delta and another 230 miles of levees in the Suisun Marsh area (California Department of Water Resources 2005). Some of these are project levees that are part of the State Plan of Flood Control (SPFC) and subject to state and federal oversight and regulation. The majority of Delta Levees are non-project levees, built and improved by local interests, primarily to drain islands and tracts in the Delta so they could be put into agricultural use (California Department of Water Resources 2005); they also serve other purposes, including preservation of water quality and conveyance for export water flows. These levees were built without State and/or federal assistance but have status under California Water Code. The non-project levees are under the jurisdiction of public agencies (reclamation districts) and eligible for State assistance due to their acknowledged special benefits to State interests. There are also other levees that may be owned by private or public entities that do not have the same eligibility status as the Delta's non-project levees.

Emergency preparedness and response is primarily a local responsibility, although State assistance is available after local entities have reached their capacity to respond. The federal government may also have an interest due to public safety, environmental and socioeconomic concerns.

The construction of levees in the Delta began about 150 years ago. Delta levees are vulnerable to failure because they continuously hold back water and most were built with soils dredged from nearby channels and were not subject to engineering standards. Because the land on many Delta islands is currently 25 feet or more below sea level, deep flooding could occur at any time due to a levee failure event. Such an event could degrade the quality and disrupt the availability of Delta water (California Department of Water Resources 2012).

Levee failure can result from many causes, including the combination of high river inflows, high tide, and high winds, or seismic events. Levees can also fail in fair weather—even in the absence of a flood or seismic event—in a so-called "sunny day event." Damage caused by rodents, piping (in which a pipe-like opening develops below the base of the levee), or foundation movement can cause sunny-day levee breaches (California Department of Water Resources 2012).

A breach of one or more levees and the associated island flooding could affect Delta water quality and SWP and CVP operations. Depending on the hydrology and the size and locations of the breaches and flooded islands, salt water may be pulled into the interior Delta from Suisun and San Pablo bays. When certain islands are flooded, Delta exports may need to drastically decrease or even cease to avoid drawing saline water toward the Banks and Jones pumping plants.

Although the condition of the Delta levees is improving due to the investment of State funds, the failure of an individual levee could happen at any time because the Delta islands are below sea level. Such a sunny day failure occurred in 2004 on Middle River, which flooded Upper and Lower Jones Tract, inundating 12,000 acres of farmland with about 160,000 af of water. Following the levee break, Delta export pumping was curtailed for several days to prevent the intrusion of saline water into the Delta. Water shipments down the California Aqueduct were continued through unscheduled releases from San Luis Reservoir. Also, Shasta and Oroville reservoir releases were increased to provide for salinity control in the Delta.

According to the Delta Risk Management Strategy (DRMS), Phase 1: Risk Analysis (California Department of Water Resources 2007), the risk of levee failure in the Delta is significant. Since 1900, 158 levee failures have occurred (California Department of Water Resources 2008b). Some islands have been flooded and recovered multiple times. A few islands, such as Franks Tract, have never been recovered.

Levee failures may be isolated events that affect only a single island, or they may involve multiple islands at the same time. The potential for a single-island event to affect conveyance depends on the location of the island, the conditions in the Delta, and timing of the event. The failure of an island located along current conveyance routes (e.g., Old and Middle rivers) could have a much greater effect on Delta water exports than a failure at some other locations. In addition, because the operation of the export pumps varies over the course of a year, the effects of a single-island levee failure event on conveyance would vary from no effect to disruption of pumping for several days or weeks, according to the time of year at which it occurred.

As discussed in the No Action Alternative, sea-level rise could result in an increased risk of levee failure if the levees are not maintained and improved to accommodate the additional load. However, the State has programs and partners in the local agencies to support necessary levee improvements to minimize any increase in risk. It will be important to continue supporting these programs and to provide funds for the improvement of the levees in order to minimize the potential for inundation of the Delta islands. Without the programs and funding, the potential effects on Delta water supplies could be very significant.

Seismically Induced Levee Failures

The Delta is in an area of moderate seismic risk. A moderate to strong earthquake could cause simultaneous levee failures on several Delta islands, with resultant island flooding. The potential for levee failure to result from a seismic event was the subject of analyses conducted by the CALFED program and Phase I of the DRMS. In 2002, the Working Group on California Earthquake Probabilities estimated that an earthquake of magnitude 6.7 or greater has a 62 percent probability of occurring in the San Francisco Bay Area before 2032, and could cause 20 or more islands to flood at the same time (URS Corporation and Benjamin & Associates 2009).

As discussed in the DRMS analysis, a major earthquake could flood many islands simultaneously, which would result in the influx of saline water into the Delta and could require the immediate cessation of water exports. The subsequent repair of levee breaches after the earthquake could require several months, after which the Delta would have to be restored to a fresh condition. Freshening the Delta could involve releases from upstream reservoirs to flush saline water from the Delta. Emergency provisions of existing laws may be used in order to provide the ability to pump water for SWP and CVP to avoid or minimize adverse health and safety effects resulting from the reduced water supply conditions related to a seismic event.

Flood-Related Failures

The potential for a flood event to result in damage to levees, structures, and result in the loss of life has been evaluated in several studies, including DRMS and the Central Valley Flood Protection Plan (California Department of Water Resources 2011b). Generally, these studies have focused on characterizing the potential flood risk, estimating the extent of flood damage, and describing options to mitigate flood risks and reduce flood damage. Storm-related flooding tends to fill the Delta and Suisun Marsh with fresh water, thereby making disruption of the export supply less likely. The 2009 SWP Reliability Report (California Department of Water Resources 2010a) acknowledges the potential for disruption of Delta exports from a flood event would depend on the number of flooded islands, the timing and size of the flood flows, and the water quality in the Delta and Suisun Bay at the time of the flood.

Funding from the Delta Levees Subventions and Delta Special Flood Control Projects Programs have assisted reclamation districts with system maintenance, levee repairs, and levee improvements, which have improved overall levee performance in the Delta. The annual funding has ranged from 2 million to 50 million dollars. Continued funding of those programs would likely result in additional improvements to levee performance. However, the cost of a comprehensive program to manage risk across the Delta has been estimated at between $10.5 and $17.5 billion (California Department of Water Resources 2011c). Costs of this magnitude likely exceed the funding ability of local reclamation districts and may not be available from the State or federal governments. Thus, the ability to implement widespread levee improvements in advance of anticipated increases in flood peaks or sea-level rise or due to climate change is uncertain.

As noted above, the potential consequences for water exports as a result of a levee failure during flood conditions would depend on the specific levee reach and its relation to export conveyance. Since the Delta and Suisun Marsh will contain significantly more fresh water, the potential for salt contamination and any need to curtail exports for water quality reasons is reduced. However, once flood flows subside, saline water would be expected to re-enter the Delta system. The levee breaches remaining after the flood could have altered flow patterns in the Delta and would have to be evaluated for their effects on exports and in-Delta water quality. Where adverse effects remain, closure of the breaches would restore the function of the levee system in preserving water quality and conveyance. It is unlikely that a single-island failure during flood conditions could result in a reduction or disruption to Delta water exports, although it is possible that multiple-island levee failure events, unless repaired, could affect water exports for a longer period.

Potential Effects on the Export of Delta Water Supplies from Levee Failures

In the past several years, DWR, USACE, the Delta Protection Commission, and local agencies have worked to improve the response to an in-Delta flood emergency, such as a levee failure. As a result, DWR and local agencies are better prepared to respond effectively through improved planning and coordination and the stockpiling of materials. Thus, in the event of a threatened levee breach, local agencies will respond immediately and will notify the County Office of Emergency Services and DWR

Flood Center of an event. If needed, additional supplies and support are available. If a levee breach were to occur on a single island (such as occurred at Jones Tract), a unified response effort would be pursued. As part of the implementation of that response, planning teams consider impacts on systems, including the export water system. If the export water system were compromised, restoration of its full function would be incorporated into the response plan so that repairs could be completed in a relatively short timeframe (e.g., a few weeks or months). Thus, for most single-island events, the effect on Delta water exports would generally be limited to a relatively short interruption, until it is confirmed that the resumption of exports would not draw saline water into the Delta.

Various analyses have been undertaken to understand the risk and probability of a more widespread levee failure event, and to determine the potential impact to conveyance of water across the Delta. This included DRMS, an action envisioned by the CALFED ROD in 2000, which provided data to meet the requirements of Assembly Bill (AB) 1200 (California Department of Water Resources and California Department of Fish and Game 2008). Adopted by the legislature in 2005, AB 1200 amended the California Water Code[17] to require that DWR conduct an analysis of the potential for potential impacts on Delta water supplies from subsidence, earthquakes, floods, and changes in precipitation, temperature, and ocean levels. For further discussion of impacts of seismic risks and climate change see Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies*.

Appendix 5B discusses the potential responses of urban and agricultural water users to abrupt disruptions in Delta water supplies. As discussed more fully therein, urban water user responses could include increased reliance on reservoir storage, expanded groundwater reliance, increased water transfers from agricultural uses to urban uses, increased use on recycled water, and water use restrictions. Responses from agricultural water users could include increased reliance on reservoir storage, expanded groundwater reliance, and water conservation measures.

Indirect effects of changes in Delta exports due to abrupt reductions in Delta water supply are further addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Change in Delta Exports

Average annual Delta exports (SWP and CVP exports through Banks and Jones Pumping Plants) under the No Action Alternative would be reduced by about 703 TAF (14%) compared to Existing Conditions (Table 5-5) because of sea level rise and climate change, increased outflows to meet Fall X2 in wet and above normal years, increased projected urban water demands, and other changes explained previously in this section, as shown in Figures 5-17 through 5-19. Figure 5-20 shows that exports would be reduced in almost all years under the No Action Alternative as compared to Existing Conditions. Increased system inflow during January through March due to climate change would not result in increased exports during this period generally because of limited demands and limited conveyance and storage capacity in these months. Average monthly total SWP and CVP exports, as shown in Figures 5-21 through 5-23, exhibit reductions in the fall months because of

[17] California Water Code § 139.2: The department shall evaluate the potential impacts on water supplies derived from the Sacramento-San Joaquin Delta based on 50-, 100-, and 200-year projections for each of the following possible impacts on the delta: (1) Subsidence; (2) Earthquakes; (3) Floods; (4) Changes in precipitation, temperature, and ocean levels; (5) A combination of the impacts specified in paragraphs (1) to (4), inclusive.

increased Delta outflow for Fall X2. Export reductions that begin in June and continue through Fall under the No Action Alternative as compared to Existing Conditions are due to reduced carryover storage and increased urban demands.

Overall, SWP and CVP water exports would decrease under the No Action Alternative as compared to Existing Conditions and could result in reductions in CVP and SWP deliveries. The following summarizes the types of responses to the reductions in water supply that are anticipated to occur.

Monthly Delta export patterns are presented in Figures 5-21 through 5-29. Results for changes in Delta exports are presented in more detail in Appendix 5A BDCP EIR/S Modeling.

Urban Responses

Exports of Delta water supplies have been reduced as a result of legislative and regulatory actions. Additional regulatory actions could result in further reductions, although a specific estimate would be difficult to quantify. Prior responses from urban water agencies in periods of drought provide useful examples of how those agencies could respond to further reductions of Delta water supplies. Reductions that occur as a result of regulatory or policy decisions are likely to remain in place for some time (unless and until some alternative program or projects can address the underlying issues which were the impetus for the regulatory action). Thus, it is likely that any such reductions would at a minimum remain in place for a period of years, or could essentially be permanent.

The effect on individual water agencies would vary considerably, as some are almost entirely reliant on exports of Delta water supplies, while for others these sources provide only a portion of their water supply portfolios, and other water sources could remain available. For example, in 2010, supplies exported from, or diverted in, the Delta comprised approximately 89 percent of the total water supplies for the Zone 7 Water Agency (Zone 7 Water Agency 2010), while the SWP provides less than 30 percent of water supplies for Metropolitan.

The timing of the reduction would also influence the potential response: if the reduction occurred during an ongoing drought, the response would be more significant than if it occurred during a period of above-average precipitation, when water agencies would likely have more options available. However, as any such reductions would remain in place for a considerable period, it is assumed that most urban water agencies would likely proceed cautiously.

The responses of urban water users of reduced exports of Delta water supplies are discussed further in Appendix 5B. As described therein, responses could include voluntary conservation measures, increased reliance on reservoir storage, increased reliance on groundwater, implementation of contingency planning efforts, increased use of recycled water, increased water transfers, increased reliance on desalination as a water supply, and water use restrictions.

Agricultural Responses

The San Joaquin Valley is among the most productive agricultural regions in the world, each year generating more than $23 billion in farm output and supporting more than 200,000 jobs. This success can largely be attributed to the availability of water supplies through the Delta and delivered by the SWP and CVP.

As noted above, exports of Delta water supplies have been reduced as a result of legislative and regulatory actions. Responses from individual agricultural water agencies and agriculture overall, to previous reductions and during periods of drought provide useful examples of how those agencies would respond. Reductions that occur as a result of a regulatory or policy decision are assumed to remain in place for some time. Thus, it is likely that any such reductions would remain for several years or could be permanent.

The responses of water agencies to extended droughts provide good insights into the effects of further reductions in exports of Delta water supplies. The 1987–1992 drought had severe impacts on water agencies. Many purchased water from alternative sources to offset reduced Delta supplies, often at very high costs that some clients were unable to afford. Farmers responded to the resultant higher costs by increasing their own groundwater pumping and reducing their purchases from water agencies, but also fallowed large acreages of both annual and permanent crop land. The financial viability of some water agencies themselves suffered and was reflected in increased credit risks and downgrades by credit rating agencies because of these reduced supplies (Moody's Investors Service 1994).

The effect on individual agricultural agencies would vary considerably, as some are almost entirely reliant on exports of Delta water supplies, while for others these sources provide only a portion of their water supply portfolios, and those other water sources could remain available. For example, during the period of 1978 to 2006, Westlands Water District relied on CVP deliveries for an average of 73 percent of its total supplies (Westlands Water District 2007).

The timing of the reduction would also influence the potential response: if the reduction occurred during an ongoing drought, the response would be more significant than if it occurred during a period of above-average precipitation, as water agencies would have more options available. In prolonged droughts, however, water supply reductions impact agriculture and extend in other directions as well. In many small San Joaquin Valley towns, agriculture is the dominant business sector and employer. The City of Mendota, for example, was devastated by the 1987-1992 drought and regulatory water reallocations (Villarejo 1996). The small agricultural towns in the San Joaquin Valley suffered severe losses of output and income and jobs with attendant increases in social service costs.

The responses of agricultural water users of reduced exports of Delta water supplies are discussed further in Appendix 5B. As described therein, responses could include increased reliance on reservoir storage, increased reliance on groundwater, and water conservation programs.

Increased Transfer Demand

Demands for supplemental water supplies to offset declines in SWP and CVP allocations will increase. Demand for cross-Delta water transfers will increase, with the frequency of such transfers increasing from about 52 percent of years to 68 percent of years compared to existing conditions. The demand increases by project are: from about 23 percent of years to 39 percent of years for the SWP, and from about 51 percent of years to 67 percent of years for the CVP. The average annual transfer demand volume could increase from about 146,000 acre-feet to about 280,000 acre-feet, assuming an estimated maximum cross-Delta transfer supply of 600,000 acre-feet in any one year. Cross-Delta Transfer capacity would restrict the actually realized increase in transfer volumes to less than the amounts stated by an unknown degree, but the increase in the frequency of Cross-Delta transfers would likely occur as predicted as a result of the predicted 14 percent reduction in Delta exports for SWP and CVP Project deliveries.

As noted elsewhere, the decreases in project deliveries (and consequential increase in transfer demand) are caused by (1) an increase in demands associated with water rights, the buildout of planned facilities, and greater use of existing CVP and SWP contracts which cumulatively result in about 443 TAF per year additional consumptive use per year north of Delta at the future level of development; (2) climate change and sea level rise; and (3) depending on alternative, assumption of certain added Delta outflows to benefit fish.

Indirect effects of changes in Delta exports are further addressed in Chapter 30, *Growth Inducement and Other Indirect Effects*, and other chapters addressing specific resources.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

No construction or modification to SWP or CVP facilities would occur under the No Action Alternative.

***CEQA Conclusion*:** No construction or modification to SWP or CVP facilities would occur under the No Action Alternative.

Impact WS-2: Change in SWP and CVP Deliveries

The effects of sea level rise and climate change, increase in north of Delta urban demands and implementation of Fall X2 in wet and above normal years under the No Action Alternative would cause changes in SWP and CVP deliveries as compared to Existing Conditions. Average annual total CVP deliveries would decrease by 172 TAF (4%) and average annual total south of the Delta CVP deliveries would decrease by about 280 TAF (13%) as compared to deliveries under Existing Conditions. Average annual CVP north of Delta agricultural deliveries would be reduced by 73 TAF (31%) and exhibit reductions in about 95% of years under the No Action Alternative as compared to Existing Conditions, as shown in Figure 5-30. Average annual CVP south of Delta agricultural deliveries would be reduced by 240 TAF (25%) and exhibit reductions in about 90% of the years, as shown in Figure 5-31. Average annual CVP north of Delta M&I deliveries would increase by 171 TAF (81%) due to the increase in urban demand as described in section 5.3.3.1. Deliveries would increase in all years, as shown in Figure 5-32. Average annual CVP south of Delta M&I deliveries would be reduced by 13 TAF (11%) in about 95% of the years, as shown in Figure 5-33.

Model results show a 52 TAF (3%) decrease in CVP Settlement Contract deliveries and a 21 TAF (5%) decrease in CVP Level 2 Refuge Water Supplies during dry and critical years compared to the Existing Conditions. This is because Shasta Lake storage would decline to dead pool more frequently due to the shift in runoff patterns from climate change, increased releases for Fall X2, and increased demands as explained above. Results show no changes in deliveries to CVP Exchange Contractors. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

Average annual total SWP deliveries would decline by 394 TAF (11%). Average annual total SWP south of Delta deliveries (including Article 56[18] and Article 21) would be reduced by about 370 TAF

[18] In accordance with Monterey Agreement Article 56, SWP contractors may choose to keep a portion of their allocated water in a certain year in project surface conservation facilities and request it in a subsequent year. Article 56 deliveries in this document refers to water that was previously stored in project storage facilities delivered to contractors in a certain year.

(14%) and exhibit reductions in about 95% of the years under No Action Alternative as compared to Existing Conditions, as shown in Figure 5-34. Average annual SWP Table A deliveries would reduce by 264 TAF (10%) and average annual SWP south of Delta Table A deliveries (including Article 56) would be reduced by about 275 TAF (11%). South of Delta Table A deliveries would be reduced in about 95% of the years, as shown in Figure 5-35. Average annual SWP south of Delta Article 21 deliveries would be reduced by about 111 TAF (70%) and would decrease in almost all years, as shown in Figure 5-36. There would be an average annual decrease of 55 TAF (6%) in SWP Feather River Service Area deliveries during dry and critical years compared to the Existing Conditions.

Overall, SWP and CVP water deliveries would decrease under the No Action Alternative as compared to Existing Conditions.

For a discussion of the potential responses of SWP and CVP water users to reduced SWP and CVP deliveries, please refer to Appendix 5B, *Responses to Reduced South of Delta Exports.* As explained therein, responses of urban water users could include voluntary conservation measures, increased reliance on reservoir storage, increased reliance on groundwater, implementation of contingency planning efforts, increased use of recycled water, increased water transfers, increased reliance on desalination as a water supply, and water use restrictions. Responses of agricultural water users could include increased reliance on reservoir storage, increased reliance on groundwater, and water conservation programs.

Indirect effects of changes in water deliveries are further addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Results for SWP and CVP deliveries are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

CEQA Conclusion: The reductions in SWP and CVP water deliveries under the No Action Alternative as compared to Existing Conditions would be mainly due to a combination of effects of sea level rise and climate change, increased future upstream and in-delta water demand (having priority over SWP and CVP rights) and implementation of Fall X2. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Demands for supplemental water supplies to offset declines in SWP and CVP allocations will increase. Demand for cross-Delta water transfers will increase, with the frequency of such transfers increasing from about 52 percent of years to 68 percent of years, increasing from about 23 percent of years to 39 percent of years for the SWP, and from about 51 percent of years to 67 percent of years for the CVP. The average annual transfer demand volume could increase from about 146,000 acre-feet to about 280,000 acre-feet, assuming an estimated maximum cross-Delta transfer supply of 600,000 acre-feet in any one year. Cross-Delta transfer capacity would restrict the actually realized increase in transfer volumes to less than the amounts stated by an unknown degree, but the increase in the frequency of Cross-Delta transfers would likely occur as predicted as a result of the predicted 14 percent reduction in Delta exports for project deliveries.

CEQA Conclusion: Demands for supplemental water supplies to offset declines in SWP and CVP allocations will increase, and demand for cross-Delta water transfers will increase, due to reductions in SWP and CVP water deliveries. The reductions in SWP and CVP water deliveries under the No

Action Alternative as compared to Existing Conditions would be mainly due to a combination of effects of sea level rise and climate change, increased future upstream and in-Delta water demand or in-basin consumptive use (having priority over SWP and CVP rights) and implementation of Fall X2.

5.3.3.2 Alternative 1A—Dual Conveyance with Pipeline/Tunnel and Intakes 1–5 (15,000 cfs; Operational Scenario A)

Alternative 1A would include construction of five intakes and pumping plants, and other associated facilities; two forebays; conveyance pipelines; and tunnels to convey water from the north Delta to the south Delta pumping facilities. Alternative 1A water conveyance operations would follow the operational criteria described as Scenario A. These operations criteria are described in detail in Section 3.6.4.2 in Chapter 3, *Description of Alternatives*, and in Appendix 5A, *BDCP EIR/S Modeling.*

A description of the changes in Delta outflow, reservoir storage, Delta exports, and SWP and CVP deliveries is provided below. The results for Alternative 1A, like those for the No Action Alternative, include sea level rise and climate change that would occur at late long-term [LLT] around Year 2060. As described in Section 5.3.1 Methods of Analysis, sea level rise and climate change affect SWP and CVP operations and require additional water to be released from SWP and CVP reservoirs to meet Delta water quality requirements.

Summary of Water Supply Operations under Alternative 1A

Change in Delta Outflow

Changes in average annual Delta outflow under Alternative 1A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Long-term average and wet year outflows would decrease in January through May and July through September compared to the No Action Alternative due to the increase in SWP and CVP exports because of the additional north Delta intake capacity and because Alternative 1A does not include operations to meet Fall X2. The decrease in April and May outflow would also be attributable to the increase in Delta exports since Alternative 1A does not include the San Joaquin River Inflow-Export Ratio (as defined in the NMFS BiOp RPA Action IV.2.1) that reduces exports under Existing Conditions and the No Action Alternative. The timing of seasonal outflows in dry year types would be similar to No Action Alternative.

The incremental changes in Delta outflow between Alternative 1A and Existing Conditions would be a function of both the facility and operations assumptions of Alternative 1A and the reduction in water supply availability due to sea level rise and climate change.

Results for changes in Delta Outflow are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 1A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-4 through 5-6 for Trinity Lake, Shasta lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in figures 5-13 through 5-16 for completeness. Results for changes in SWP and CVP reservoir storages are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Trinity Lake

Average annual end of September Trinity Lake storage would decrease by 38 TAF (3%) compared to the No Action Alternative and exhibit a decrease in about 80% of the years, as shown in Figure 5-6.

Average annual end of September Trinity Lake storage would decrease by 269 TAF (19%) compared to Existing Conditions and exhibit a decrease in almost all of the years, as shown in Figure 5-6. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 1A and the results show that average annual end of September Trinity Lake storage would decrease under Alternative 1A as compared to the conditions without the project.

Shasta Lake

Average annual end of September Shasta Lake storage would increase by 43 TAF (2%) compared to the No Action Alternative and exhibit an increase in about 60% of the years, as shown in Figure 5-8.

Average annual end of September Shasta Lake storage would decrease by 438 TAF (16%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-8. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 1A and the results show that average annual end of September Shasta Lake storage would increase under Alternative 1A as compared to the conditions without the project.

Lake Oroville

Average annual end of September Lake Oroville storage would increase by 354 TAF (25%) compared to the No Action Alternative and exhibit an increase in almost all of the years, as shown in Figure 5-10.

Average annual end of September Lake Oroville storage would decrease by 292 TAF (14%) compared to Existing Conditions and exhibit a decrease in about 85% of the years, as shown in Figure 5-10. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 1A and the results show that average annual end of September Lake Oroville storage would increase under Alternative 1A as compared to the conditions without the project.

Folsom Lake

Average annual end of September Folsom Lake storage would increase by 21 TAF (5%) compared to the No Action Alternative and exhibit an increase in about 65% of the years, as shown in Figure 5-12.

Average annual end of September Folsom Lake storage would decrease by 125 TAF (24%) compared to Existing Conditions and exhibit a decrease in about 90% of the years, as shown in Figure 5-12. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 1A and the results show that average annual end of September Folsom Lake storage would increase under Alternative 1A as compared to the conditions without the project.

Change in Delta exports

Changes in average annual Delta exports under Alternative 1A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-13 through 5-20 and Tables 5-4 through 5-6.

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 1A (such as north Delta diversions, not including San Joaquin Inflow/Export Ratio, and the reduction in Delta outflow because there would be no Fall X2 requirement) change SWP and CVP Delta exports as compared to Delta exports under Existing Conditions and the No Action Alternative. Total long-term average annual Delta exports under Alternative 1A would increase as compared to exports under Existing Conditions and No Action Alternative.

However, the incremental increase compared to Existing Conditions would reflect changes in operations due to Alternative 1A and due to SWP and CVP operations with sea level rise and climate change that would occur without implementation of Alternative 1A.

Monthly Delta export patterns are presented in Figures 5-21 through 5-29. Results for changes in Delta exports are presented in more detail in Appendix 5A BDCP EIR/S Modeling.

Change in SWP and CVP Deliveries

Changes in SWP and CVP deliveries under Alternative 1A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 1A, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

***CEQA Conclusion*:** Constructing Alternative 1A water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 1A would provide operational flexibility that would allow the SWP and CVP to increase Delta exports and resulting south of Delta water deliveries compared to deliveries under Existing Conditions and the No Action Alternative.

Results for SWP and CVP deliveries are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Total CVP Deliveries

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries would increase by 263 TAF (6%) and by 237 TAF (12%), respectively, compared to deliveries under the No Action Alternative.

Under Alternative 1A, average annual total CVP deliveries would increase by 90 TAF (2%), where average annual total south of the Delta CVP deliveries would decrease by about 43 TAF (2%) compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 1A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total CVP south of Delta deliveries would increase under Alternative 1A as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Average annual CVP north of Delta agricultural deliveries would increase by 18 TAF (11%) compared to the No Action Alternative and exhibit an increase in almost 50% of the years, as shown in Figure 5-30.

Average annual CVP north of Delta agricultural deliveries would be reduced by 55 TAF (23%) compared to Existing Conditions. This decrease primarily would occur due to sea level rise and climate change and increased north of Delta demands.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 1A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta agricultural deliveries would increase under Alternative 1A as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Average annual CVP south of Delta agricultural deliveries would increase by 229 TAF (31%) compared to the No Action Alternative with the increase occurring in about 60% of years, as shown in Figure 5-31.

Average annual CVP south of Delta agricultural deliveries would be reduced by 11 TAF (1%) compared to Existing Conditions. This decrease primarily would occur due to sea level rise and climate change and increased north of Delta demands.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 1A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta agricultural deliveries would increase under Alternative 1A as compared to the conditions without the project.

CVP Settlement and Exchange Contractor Deliveries

There would be no change to CVP Settlement Contract deliveries under Alternative 1A as compared to deliveries under the No Action Alternative.

There would be an average annual decrease of 55 TAF (3%) in CVP Settlement Contract deliveries during dry and critical years under Alternative 1A as compared to deliveries under Existing Conditions because Shasta Lake storage declines to dead pool more frequently, primarily due to increased north of Delta demands and sea level rise and climate change. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

There would be no changes in deliveries to CVP Exchange Contractors under Alternative 1A.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 1A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years would be the same (or less than 1% change) under Alternative 1A as compared to the deliveries under the No Action Alternative. Therefore, CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years under Alternative 1A would be similar to the deliveries under the conditions without the project.

CVP North of Delta Municipal and Industrial Deliveries

Average annual CVP north of Delta M&I deliveries would increase by 3 TAF (1%) under Alternative 1A compared to the deliveries under the No Action Alternative and deliveries would be similar in all years, as shown in Figure 5-31.

Average annual CVP north of Delta M&I deliveries would increase by 174 TAF (83%) as compared to deliveries under Existing Conditions and deliveries would be higher in all years compared to Existing Conditions, as shown in Figure 5-32. This increase primarily would occur because there would be an increase in north of Delta M&I water rights demands under Alternative 1A and No Action Alternative as compared to demands under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 1A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries would increase under Alternative 1A as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries would increase under Alternative 1A as compared to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Average annual CVP south of Delta M&I deliveries would increase about 10 TAF (9%)under Alternative 1A compared to the deliveries under the No Action Alternative with increased deliveries occurring in about 60% of years, as shown in Figure 5-33.

Average annual CVP south of Delta M&I deliveries would decrease about 3 TAF (3%) compared to the deliveries under Existing Conditions. Deliveries would increase in about 30% of the years under wetter conditions and decease in about 40% of the years under drier conditions, as shown in Figure 5-33.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 1A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta M&I deliveries would increase under Alternative 1A as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta M&I deliveries would increase under Alternative 1A as compared to the conditions without the project.

Total SWP Deliveries

Average annual total SWP deliveries would increase by 770 TAF (23%) compared to deliveries under the No Action Alternative. Average annual total south of the Delta SWP deliveries, including Table A (including Article 56) plus Article 21 deliveries, under Alternative 1A would increase by about 751 TAF (32%) as compared to deliveries under the No Action Alternative (South of Delta Table A contractors receive allocations). Alternative 1A SWP south of Delta deliveries would increase in about 80% of years and would be similar in almost 20% of years, as shown in Figure 5-34.

Average annual total SWP deliveries would increase by 376 TAF (10%) compared to deliveries under Existing Conditions. Average annual total south of the Delta SWP deliveries, including Table A (including Article 56) plus Article 21 deliveries, under Alternative 1A would increase by about 381 TAF (14%) as compared to deliveries under Existing Conditions. Alternative 1A SWP south of Delta deliveries would increase in about 70% of years during wetter periods and decrease in almost 30% of years during drier periods compared to Existing Conditions, as shown in Figure 5-34.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 1A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total SWP south of Delta deliveries would increase under Alternative 1A as compared to the conditions without the project.

SWP Table A Deliveries

Average annual SWP Table A deliveries with Article 56 (without Article 21) would increase under Alternative 1A by about 566 TAF (24%) as compared to deliveries under the No Action Alternative.

Average annual SWP Table A south of Delta deliveries with Article 56 (without Article 21) would increase under Alternative 1A by about 550 TAF (24%) as compared to deliveries under the No Action Alternative. Alternative 1A SWP south of Delta Table A deliveries would increase in about 80% of years and would be similar in about 20% of years, as shown in Figure 5-35.

Average annual SWP Table A deliveries with Article 56 (without Article 21) would increase under Alternative 1A by about 302 TAF (12%) as compared to deliveries under Existing Conditions.

Average annual SWP Table A south of Delta deliveries with Article 56 (without Article 21) would increase under Alternative 1A by about 275 TAF (11%) as compared to deliveries under Existing Conditions. Alternative 1A SWP south of Delta Table A deliveries would increase in about 70% of years during wetter conditions and decrease in almost 30% of years during drier periods, as shown in Figure 5-35.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 1A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP south of Delta Table A deliveries would increase under Alternative 1A as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP south of Delta Table A deliveries would increase under Alternative 1A as compared to the conditions without the project.

SWP Article 21 Deliveries

Average annual SWP Article 21 deliveries would increase by about 200 TAF (423%) compared to deliveries under the No Action Alternative with an increase in all years when Article 21 water would be available, as shown in Figure 5-36.

Average annual SWP Article 21 deliveries would increase by about 89 TAF (56%) compared to deliveries under Existing Conditions. The frequency of Article 21 deliveries under Alternative 1A would increase about 20% as compared to deliveries under Existing Conditions, as shown in Figure 5-36.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 1A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual Article 21 deliveries would increase under Alternative 1A as compared to the deliveries under the No Action Alternative. Therefore, average annual Article 21 deliveries would increase under Alternative 1A as compared to the conditions without the project.

Feather River Service Area

There would be an average annual increase of 11 TAF (1%)in SWP Feather River Service Area deliveries during dry and critical years under Alternative 1A as compared to deliveries under the No Action Alternative.

There would be an average annual decrease of 44 TAF (5%)in SWP Feather River Service Area deliveries during dry and critical years under Alternative 1A as compared to deliveries under Existing Conditions. The primary cause of this reduction would be change in SWP operations due to sea level rise and climate change.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 1A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries would increase under Alternative 1A as compared to the deliveries under the No Action. Therefore, average annual SWP Feather River Service Area deliveries would increase under Alternative 1A as compared to the conditions without the project.

NEPA Effects: Overall, SWP and CVP deliveries would increase under Alternative 1A as compared to deliveries under No Action Alternative. Indirect effects of changes in water deliveries in addition to potential effects on urban areas caused by changes in SWP and CVP water supply deliveries, are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 1A would decline as compared to deliveries under Existing Conditions. The primary cause of the reduction that would occur under Alternative 1A would be due to increased north-of-Delta water demands and changes in SWP and CVP operations resulting from sea level rise and climate change. As shown above in the NEPA analysis, SWP and CVP deliveries would either not change or would increase under Alternative 1A as compared to deliveries under conditions in 2060 without Alternative 1A if sea level rise and climate change conditions are considered the same under both scenarios. SWP and CVP deliveries under Alternative 1A would increase as compared to deliveries under Existing Conditions without the effects of increased north-of-Delta water demands, sea level rise, and climate change. Indirect effects of changes in water deliveries in addition to potential effects on urban areas caused by changes in SWP and CVP water supply deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

The relationship between Alternative 1A water supply and resulting demand for water transfers involves a number of variables: differences in demand for transfer water as compared to existing conditions and the No Action Alternative, potential increased cross-Delta transfer capacity due to the BDCP facilities, and a longer transfer window, as explained below.

Differences in demand for transfer water

Alternative 1A increases the combined SWP Table A and CVP south-of-Delta agricultural allocations as compared to existing conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would decrease slightly, although the total volume of those transfers is likely to increase. The demand for water transfers to supplement supply shortages is estimated to decrease from 52 percent of years to 46 percent of years compared to existing conditions, and the average annual cross-Delta transfers are estimated to increase from 146,000 acre-feet to about 194,000 acre-feet per year compared to existing conditions assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Alternative 1A increases project water supply allocations as compared to the No Action Alternative, and consequently will decrease cross-Delta water transfer demand compared to that alternative. The demand for water transfers to supplement supply shortages is estimated to decrease from 68 percent of years to 46 percent of years compared to the No Action Alternative, and the average annual volume of cross-Delta transfers is estimated to decrease from about 280,000 acre-feet per year to about 194,000 acre-feet per year compared to the No Action Alternative.

Potential increased cross-Delta transfer capacity due to BDCP and longer transfer window

Creation of a separate cross-Delta facility provides additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including BDCP permit terms. As discussed above in Section 5.1.2.7, this change could reduce or eliminate the current constraint on the export of transfer water generated outside of the current July-September transfer window, possibly facilitating more crop idling transfers, which generally develop transfer water from April through October, and also expanding the period when groundwater subsitution pumping could be conducted to include the entire irrigation season. This change is likely to make upstream-of-Delta transfers more attractive to export service area contractors at the times they need transfer water.

Water transfers made possible as a result of additional capacity created under Alternative 1A could increase Delta exports. Current SWP and CVP contractors could seek to increase supplies and their reliability by seeking transfer water above that assumed in the quantified analysis in this section and Appendix 5D. Other buyers could also seek cross-Delta transfers to increase their supplies. Transfer demand could be greater than estimated in this analysis, including developing demand in wetter year types for storage for use in drier year types. The magnitude of the increase in cross-Delta exports would depend on the decisions made by potential buyers, the availability of supplies from willing sellers and particularly their willingness to sell greater volumes of water at a greater frequency than assumed in the analyses in this EIR/EIS, the availability of export capacity after meeting SWP and CVP needs, regulatory constraints, and the characteristics of any transfers, including the volume of water affected and the timing and duration of the transfers. Any estimate of the magnitude of such transfers would be highly speculative and is not attempted. The magnitude of effects would depend on a number of factors unique to the transfer(s) in question For recipients of water transfers, any additional transfers enabled by Alternative 1A would result in an increased water supply, creating a benefit to these water users and allowing flexibility to relieve shortages.

Water transfers enabled by capacity under Alternative 1A could result in increases in Delta exports, although they would be constrained by existing or future regulatory constraints and depend on the location and extent of water transfers, along with third party actions and decisions, including willing sellers. These decisions are made at the local level after opportunity for public review and comment. Prior to approving the use of SWP or CVP facilities for conveyance of transfer water, DWR or USBR must find that the transfer would not injure any other legal user or unreasonably affect fish, wildlife or other beneficial uses. In addition, if the transfer requires SWRCB approval, the SWRCB must make similar findings.

CEQA Conclusion: Alternative 1A could decrease the number of years in which there is a demand for transfers, but could increase the average annual quantity of transfer water conveyed compared to existing conditions. Alternative 1A would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Potential effects of changes in Delta exports or water deliveries are addressed in other chapters addressing specific resources. The analysis of any potential upstream impacts from transfers is not a part of this EIR/EIS and must be covered pursuant to separate laws and regulations once the specific transfer has been proposed. Section 30.3.6 describes the general types of environmental impacts that could be associated with those transfers.

5.3.3.3 Alternative 1B—Dual Conveyance with East Alignment and Intakes 1–5 (15,000 cfs; Operational Scenario A)

Alternative 1B would include construction of five intakes and intakes pumping plants, and other associated facilities; one forebay; conveyance pipelines; and an east alignment to convey water from the north Delta to the south Delta pumping facilities rather than long segments of deep tunnel through the central part of the Delta. Alternative 1B water conveyance operations would be the same as for Alternative 1A.

Summary of Water Supply Operations under Alternative 1B

Change in Delta Outflow

Please refer Alternative 1A because the operations would be identical to those under Alternative 1A.

Change in SWP and CVP Reservoir Storage

Please refer to Alternative 1A because the operations would be identical to those under Alternative 1A.

Change in Delta Exports

The changes in Delta exports resulting from operation of Alternative 1B would be the same as those described under Alternative 1A because operations would be identical.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 1B, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

***CEQA Conclusion*:** Constructing Alternative 1B water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

NEPA Effects: The changes in SWP and CVP deliveries resulting from operation of Alternative 1B would be the same as those described under Alternative 1A, Impact WS-2 because operations would be identical.

CEQA Conclusion: SWP and CVP deliveries under Alternative 1B would decline as compared to deliveries under Existing Conditions. The primary cause of the reduction is increased north-of-Delta water demands that would occur under Alternative 1B and changes in SWP and CVP operations due to sea level rise and climate change. As shown in the NEPA analysis for Alternative 1A, SWP and CVP deliveries would either not change or would increase under Alternative 1B as compared to deliveries under conditions in 2060 without Alternative 1B if sea level rise and climate change conditions are considered the same under both scenarios. SWP and CVP deliveries under Alternative 1B would increase as compared to deliveries under Existing Conditions without the effects of increased north-of-Delta water demands, sea level rise, and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Effects from potential additional water transfers would be the same as those described under Alternative 1A. Transfers enabled by operations under Alternative 1B could result in increases in Delta exports and in SWP or CVP deliveries.

CEQA Conclusion: Alternative 1B could increase water transfer demand compared to existing conditions. Alternative 1B would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.4 Alternative 1C—Dual Conveyance with West Alignment and Intakes W1–W5 (15,000 cfs; Operational Scenario A)

Alternative 1C would include construction of five intakes and intakes pumping plants, and other associated facilities; one forebay; conveyance pipelines, western canals, a tunnel, and culvert siphons; and an intermediate pumping plant to convey water from the north Delta to the south Delta. Alternative 1C water conveyance operations would be the same as for Alternative 1A.

Summary of Water Supply Operations under Alternative 1C

Change in Delta Outflow

Please refer to Alternative 1A because the operations would be identical to those under Alternative 1A.

Change in SWP and CVP Reservoir Storage

Please refer to Alternative 1A because the operations would be identical to those under Alternative 1A.

Change In Delta Exports

The changes in Delta exports resulting from operation of Alternative 1C would be the same as those described under Alternative 1A because operations would be identical.

Change In SWP And CVP Deliveries

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 1C, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

CEQA Conclusion: Constructing Alternative 1C water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

NEPA Effects: The changes in SWP and CVP deliveries resulting from operation of Alternative 1C would be the same as those described under Alternative 1A, Impact WS-2 because operations would be identical.

CEQA Conclusion: SWP and CVP deliveries under Alternative 1C would decline as compared to deliveries under Existing Conditions. The primary cause of the reduction is increased north-of-Delta water demands that would occur under No Action Alternative and Alternative 1C and changes in SWP and CVP operations due to sea level rise and climate change. As shown in the NEPA analysis for Alternative 1A, SWP and CVP deliveries would either not change or would increase under Alternative 1C as compared to deliveries under conditions in 2060 without Alternative 1C if sea level rise and climate change conditions are considered the same under both scenarios. SWP and CVP deliveries under Alternative 1C would increase as compared to deliveries under Existing Conditions without the effects of increased north-of-Delta water demands, sea level rise, and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Effects from potential additional water transfers would be the same as those described under Alternative 1A. Transfers enabled by operations under Alternative 1C could result in increases in Delta exports and in SWP or CVP deliveries.

CEQA Conclusion: Alternative 1C could increase water transfer demand compared to existing conditions. Alternative 1C would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.5 Alternative 2A—Dual Conveyance with Pipeline/Tunnel and Five Intakes (15,000 cfs; Operational Scenario B)

Facilities construction under Alternative 2A would be identical to those described for Alternative 1A. Alternative 2A could involve relocation of two of the intakes to a location south of the confluence of Sutter and Steamboat sloughs and the Sacramento River. Alternative 2A water conveyance operations would follow the operational criteria described as Scenario B and include criteria for Fall X2 and less negative south Delta OMR flows than under Scenario A, as described in detail in Section 3.6.4.2 in Chapter 3, *Description of Alternatives,* and in the Appendix 5A, *BDCP EIR/S Modeling.*

A description of the changes in Delta outflow, reservoir storage, Delta exports, and SWP and CVP deliveries is provided below. The results for Alternative 2A include sea level rise and climate change that would occur at late long-term [LLT] around Year 2060. As described in Section 5.3.1 Methods of Analysis, sea level rise and climate change affect SWP and CVP operations and require additional water to be released from SWP and CVP reservoirs to meet Delta water quality requirements.

Summary of Water Supply Operations under Alternative 2A

Change in Delta Outflow

Changes in average annual Delta outflow under Alternative 2A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Long-term average and wet year outflows decrease in January through May and July through September due to the increase in SWP and CVP exports. The timing of seasonal outflows in dry year types would be similar to No Action Alternative.

The incremental changes in Delta outflow between Alternative 2A and Existing Conditions would be a function of both the facility and operations assumptions of Alternative 2A (including north Delta intakes capacity of 15,000 cfs, Fall X2, and less negative OMR flows) and the reduction in water supply availability due to sea level rise and climate change.

Results for changes in Delta Outflow are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 2A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-4 through 5-6 for Trinity Lake, Shasta lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in Figures 5-13 through 5-16 for completeness. Results for changes in SWP and CVP reservoir storages are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Trinity Lake

Average annual end of September Trinity Lake storage would decrease by 31 TAF (3%) compared to the No Action Alternative and exhibit a decrease in about 85% of the years, as shown in Figure 5-6.

Average annual end of September Trinity Lake storage would decrease by 261 TAF (19%) compared to Existing Conditions and exhibit a decrease in almost all of the years, as shown in Figure 5-6. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 2A and the results show that average annual end of September Trinity Lake storage would decrease under Alternative 2A as compared to the conditions without the project.

Shasta Lake

Average annual end of September Shasta Lake storage would decrease by 61 TAF (3%) compared to the No Action Alternative and exhibit a decrease in about 80% of the years, as shown in Figure 5-8.

Average annual end of September Shasta Lake storage would decrease by 542 TAF (20%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-8. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 2A and the results show that average annual end of September Shasta Lake storage would decrease under Alternative 2A as compared to the conditions without the project.

Lake Oroville

Average annual end of September Lake Oroville storage would increase by 78 TAF (6%) compared to the No Action Alternative and exhibit an increase in about 95% of the years, as shown in Figure 5-10.

Average annual end of September Lake Oroville storage would decrease by 568 TAF (28%) compared to Existing Conditions and exhibit a decrease in almost all of the years, as shown in Figure 5-10. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 2A and the results show that average annual end of September Lake Oroville storage would increase under Alternative 2A as compared to the conditions without the project.

Folsom Lake

Average annual end of September Folsom Lake storage would decrease by 8 TAF (2%) compared to the No Action Alternative and exhibit a decrease in about 60% of the years, as shown in Figure 5-12.

Average annual end of September Folsom Lake storage would decrease by 154 TAF (29%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-12. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 2A and the results show that average annual end of September Folsom Lake storage would decrease under Alternative 2A as compared to the conditions without the project.

Change in Delta exports

Changes in average annual Delta exports under Alternative 2A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-13 through 5-17 and Tables 5-4 through 5-6.

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 2A change SWP and CVP Delta exports as compared to Delta exports under Existing Conditions and the No Action Alternative. Delta exports would increase as compared to exports under No Action Alternative because of the additional capability to divert water at the north Delta intakes. Total long-term average annual Delta exports under Alternative 2A would decrease as compared to exports under Existing Conditions due to less negative OMR flows, implementation of Fall X2, and sea level rise and climate change. However, the incremental increase as compared to

Existing Conditions would reflect changes in operations due to Alternative 2A and due to SWP and CVP operations with sea level rise and climate change that would occur without implementation of Alternative 2A.

Monthly Delta export patterns are presented in Figures 5-21 through 5-29. Results for changes in Delta exports are presented in more detail in Appendix 5A BDCP EIR/S Modeling.

Change in SWP and CVP Deliveries

Changes in SWP and CVP deliveries under Alternative 2A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 2A, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

CEQA Conclusion**:** Constructing Alternative 2A water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 2A would provide operational flexibility that would allow the SWP and CVP to increase Delta exports and resulting south of Delta water deliveries compared to deliveries under Existing Conditions and the No Action Alternative. However, the net incremental changes in deliveries under Alternative 2A as compared to Existing Conditions would be caused by the facility and operations assumptions of Alternative 2A (including north Delta intakes capacity of 15,000 cfs, Fall X2, and less negative OMR flows), and changes in sea level rise and climate change.

Results for SWP and CVP deliveries are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Total CVP Deliveries

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 2A would increase by 108 TAF (2%) and 105 TAF (5%) as compared to deliveries under No Action Alternative.

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 2A would decrease by 64 TAF (1%) and 175 TAF (8%) as compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 2A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total CVP south of Delta deliveries would increase under Alternative 2A as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Average annual CVP north of Delta agricultural deliveries would increase by 3 TAF (2%) compared to the No Action Alternative under Alternative 2A.

Average annual CVP north of Delta agricultural deliveries would be reduced by 70 TAF (30%) compared to Existing Conditions. This decrease primarily would occur due to sea level rise and climate change. Sea level rise and climate change require additional water to be released from CVP reservoirs to meet Delta water quality requirements.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 2A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total CVP south of Delta deliveries would increase under Alternative 2A as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Average annual CVP south of Delta agricultural deliveries would increase by 103 TAF (14%) compared to the No Action Alternative.

Average annual CVP south of Delta agricultural deliveries would be reduced by 137 TAF (14%) compared to Existing Conditions

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 2A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total CVP south of Delta deliveries would increase under Alternative 2A as compared to the conditions without the project.

CVP Settlement and Exchange Contractor Deliveries

CVP Settlement Contract deliveries during dry and critical years under Alternative 2A would be similar (less than 1% change) to deliveries under the No Action Alternative.

CVP Exchange Contractor deliveries during dry and critical years under Alternative 2A would be similar (less than 1% change) to deliveries under the No Action Alternative.

There would be an average annual decrease of 60 TAF (3%) in CVP Settlement Contract deliveries during dry and critical years under Alternative 2A as compared deliveries under Existing Conditions. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

CVP Exchange Contractor deliveries during dry and critical years under Alternative 2A would be similar (less than 1% change) to deliveries under the Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 2A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total CVP south of Delta deliveries would be similar under Alternative 2A as compared to the conditions without the project.

CVP North of Delta Municipal and Industrial Deliveries

Average annual CVP north of Delta M&I deliveries would be similar (less than 1% change) to deliveries under the No Action Alternative.

Average annual CVP north of Delta M&I deliveries would increase by 172 TAF (82%) as compared to deliveries under Existing Conditions. Alternative 2A north of Delta M&I deliveries increase in all years compared to Existing Conditions, as shown in Figure 5-32. These changes primarily would occur because there would be an increase in north of Delta M&I water rights demands under both Alternative 2A and No Action Alternative as compared to Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 2A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries would be similar (less than 1% change) to deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries would be similar to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Average annual CVP south of Delta M&I deliveries would increase by 5 TAF (4%) compared to the No Action Alternative.

Average annual CVP south of Delta M&I deliveries would decrease about 8 TAF (7%) as compared to deliveries under Existing Conditions

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 2A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total CVP south of Delta M&I deliveries would increase under Alternative 2A as compared to the deliveries under the No Action Alternative. Therefore, average annual total CVP south of Delta M&I deliveries would increase under Alternative 2A as compared to the conditions without the project.

Total SWP Deliveries

Average annual total SWP deliveries, including Table A (including Article 56) plus Article 21 deliveries, and average annual total south of the Delta SWP deliveries under Alternative 2A would increase by 512 TAF (15%) and 497 TAF (21%), respectively as compared to deliveries under No Action Alternative. Alternative 2A SWP south of Delta deliveries would increase in about 65% of years and would be similar or lower in about 35% of years, as shown in Figure 5-34.

Average annual total SWP deliveries and average annual total south of the Delta SWP deliveries under Alternative 2A would increase by 118 TAF (3%) and 127 TAF (5%) as compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 2A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total south of the Delta SWP deliveries would increase under Alternative 2A as compared to the deliveries under the No Action Alternative. Therefore, average annual total south of the Delta SWP deliveries would increase under Alternative 2A as compared to the conditions without the project.

SWP Table A Deliveries

Average annual SWP Table A deliveries with Article 56 (without Article 21) increase 399 TAF (17%) compared to the No Action Alternative and average annual SWP south of Delta Table A deliveries increase 386 TAF (17%) compared to the No Action Alternative.

Average annual SWP Table A deliveries with Article 56 (without Article 21) increase by about 135 TAF (5%) compared to Existing Conditions and average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) increase by about 111 TAF (4%) compared to Existing Conditions. Alternative 2A SWP Table A deliveries would increase in about 60% of years during wetter conditions and decrease in almost 40% of years during drier periods, as shown in Figure 5-35.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 2A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP south of Delta Table A deliveries would increase under Alternative 2A as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP south of Delta Table A deliveries would increase under Alternative 2A as compared to the conditions without the project.

SWP Article 21 Deliveries

Average annual SWP Article 21 deliveries would increase 110 TAF (231%) as compared to the No Action Alternative.

Average annual SWP Article 21 deliveries would be similar to Existing Conditions. The frequency of Alternative 2A Article 21 deliveries would be similar to the frequency of deliveries under Existing Conditions, as shown in Figure 5-36.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 2A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Article 21 deliveries would increase under Alternative 2A as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP Article 21 deliveries would increase under Alternative 2A as compared to the conditions without the project.

Feather River Service Area

There would be an average annual increase of 12 TAF (1%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 2A compared to deliveries under the No Action Alternative.

There would be an average annual decrease of 43 TAF (5%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 2A as compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 2A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries would increase under Alternative 2A as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP Feather River Service Area deliveries would increase under Alternative 2A as compared to the conditions without the project.

NEPA Effects: Overall, SWP and CVP deliveries would increase under Alternative 2A as compared to deliveries under No Action Alternative. This comparison provides an indication of the changes due to Alternative 2A without the effects of sea level rise and climate change. Therefore average annual SWP and CVP deliveries would increase under Alternative 2A as compared to the conditions without the project. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 2A for most SWP and CVP water users would decline as compared to deliveries under Existing Conditions The primary cause of the reduction is increased north-of-Delta water demands that would occur under Alternative 2A and changes in SWP and CVP operations due to sea level rise and climate change. As shown above in the NEPA analysis, SWP and CVP deliveries would either not change or would increase under Alternative 2A as compared to deliveries under conditions in 2060 without Alternative 2A if sea level rise and climate change conditions are considered the same under both scenarios. SWP and CVP deliveries under Alternative 2A would increase as compared to deliveries under Existing Conditions in the absence of increased north of Delta water demands, sea level rise, and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 2A increases the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to existing conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would increase slightly, as well as the volume of those transfers. The demand for water transfers to supplement supply shortages is estimated to increase from 52 percent of years to 56 percent of years compared to existing conditions, and the average annual cross-Delta transfers are estimated to increase from 146,000 acre-feet to about 217,000 acre-feet per year compared to existing conditions, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Alternative 2A increases project water supply allocations as compared to the No Action Alternative, and consequently will decrease cross-Delta water transfer demand compared to that alternative. The demand for water transfers to supplement supply shortages is estimated to decrease from 68 percent of years to 56 percent of years compared to the No Action Alternative, and the average annual volume of cross-Delta transfers is estimated to decrease from about 280,000 acre-feet per year to about 217,000 acre-feet per year compared to the No Action Alternative.

Alternative 2A provides a separate cross-Delta facility with additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including BDCP permit terms as discussed in Alternative 1A.

CEQA Conclusion: Alternative 2A would increase water transfer demand compared to existing conditions. Alternative 2A would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.6 Alternative 2B—Dual Conveyance with East Alignment and Five Intakes (15,000 cfs; Operational Scenario B)

Alternative 2B would include construction of five intakes and intakes pumping plants, and other associated facilities; one forebay; conveyance pipelines; and an east alignment to convey water from the north Delta to the south Delta pumping facilities rather than long segments of deep tunnel through the central part of the Delta. Alternative 2B water conveyance operations would be the same as for Alternative 2A.

Summary of Water Supply Operations under Alternative 2B

Change in Delta Outflow

Please refer to Alternative 2A because the operations would be identical to those under Alternative 2A.

Change in SWP and CVP Reservoir Storage

Please refer to Alternative 2A because the operations would be identical to those under Alternative 2A.

Change in Delta exports

Please refer to Alternative 2A because the operations would be identical to those under Alternative 2A.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 2B, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

CEQA Conclusion: Constructing Alternative 2B water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

NEPA Effects: The changes in SWP and CVP deliveries Delta deliveries resulting from operation of Alternative 2B would be the same as those described under Alternative 2A because operations would be identical.

CEQA Conclusion: SWP and CVP deliveries under Alternative 2B for most SWP and CVP water users would decline as compared to deliveries under Existing Conditions. The primary cause of the reduction is increased north-of-Delta water demands that would occur under No Action Alternative and Alternative 2B and changes in SWP and CVP operations due to sea level rise and climate change.

As shown in the NEPA analysis for Alternative 2A, SWP and CVP deliveries would either not change or would increase under Alternative 2B as compared to deliveries under conditions in 2060 without Alternative 2B if sea level rise and climate change conditions are considered the same under both scenarios. SWP and CVP deliveries under Alternative 2B would increase as compared to deliveries under Existing Conditions were it not for increased north-of-Delta water demands, sea level rise, and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Effects from potential additional water transfers would be the same as those described under Alternative 2A. Transfers enabled by operations under Alternative 2B could result in increases in Delta exports and in SWP or CVP deliveries.

CEQA Conclusion: Alternative 2B could increase water transfer demand compared to existing conditions. Alternative 2B would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.7 Alternative 2C—Dual Conveyance with West Alignment and Intakes W1–W5 (15,000 cfs; Operational Scenario B)

Alternative 2C would include construction of five intakes and intakes pumping plants, and other associated facilities; one forebay; conveyance pipelines, western canals, a tunnel, and culvert siphons; and an intermediate pumping plant to convey water from the north Delta to the south Delta. Alternative 2C water conveyance operations would be the same as for Alternative 2A.

Summary of Water Supply Operations under Alternative 2C

Change in Delta Outflow

Please refer to Alternative 2A because the operations would be identical to those under Alternative 2A.

Change in SWP and CVP Reservoir Storage

Please refer to Alternative 2A because the operations would be identical to those under Alternative 2A.

Change in Delta Outflow

Please refer to Alternative 2A because the operations would be identical to those under Alternative 2A.

Change in SWP and CVP Deliveries

Please refer to Alternative 2A because the operations would be identical to those under Alternative 2A.

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 2C, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

CEQA Conclusion: Constructing Alternative 2C water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

NEPA Effects: The changes in SWP and CVP deliveries Delta deliveries resulting from operation of Alternative 2C would be the same as those described under Alternative 2A because operations would be identical.

CEQA Conclusion: SWP and CVP deliveries under Alternative 2C for most SWP and CVP water users would decline as compared to deliveries under Existing Conditions. The primary cause of the reduction is increased north-of-Delta water demands that would occur under No Action Alternative and Alternative 2C and changes in SWP and CVP operations due to sea level rise and climate change. As shown above in the NEPA analysis for Alternative 2A, SWP and CVP deliveries would either not change or would increase under Alternative 2C as compared to deliveries under conditions in 2060 without Alternative 2C if sea level rise and climate change conditions are considered the same under both scenarios. SWP and CVP deliveries under Alternative 2C would increase as compared to deliveries under Existing Conditions were it not for increased north-of-Delta water demands, sea level rise, and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Effects from potential additional water transfers would be the same as those described under Alternative 2A. Transfers enabled by operations under Alternative 2C could result in increases in Delta exports and in SWP or CVP deliveries.

CEQA Conclusion: Alternative 2C could increase water transfer demand compared to existing conditions. Alternative 2C would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.8 Alternative 3—Dual Conveyance with Pipeline/Tunnel and Intakes 1 and 2 (6,000 cfs; Operational Scenario A)

Facilities construction under Alternative 3 would be similar to those described for Alternative 1A with only two intakes. Alternative 3 water conveyance operations would follow the same operational criteria as Alternative 1A.

Changes in Delta outflow, reservoir storage, Delta exports, and SWP and CVP deliveries are provided below. The results for Alternative 3 include sea level rise and climate change that would occur at late long-term [LLT] around Year 2060. As described in Section 5.3.1, *Methods of Analysis*, sea level rise and climate change affect SWP and CVP operations and require additional water to be released from SWP and CVP reservoirs to meet Delta water quality requirements.

Summary of Water Supply Operations under Alternative 3

Change in Delta Outflow

Changes in average annual Delta outflow under Alternative 3 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Long-term average, wet, and dry year outflows would decrease in February through April and July through September as compared to outflows under the No Action Alternative. The decrease in outflows would be attributable to the increase in SWP and CVP exports because of the additional north Delta intake capacity and because Alternative 3 does not include operations to meet Fall X2 or San Joaquin River inflow-export ratio requirements.

The incremental decrease in Delta outflow between Alternative 3 and Existing Conditions would be a function of both the facility and operations assumptions of Alternative 3 (including north Delta intakes capacity of 6,000 cfs, no Fall X2 or San Joaquin River Inflow-Export ratio requirements) and the reduction in water supply availability due to increased north-of Delta demands, sea level rise and climate change.

Results for changes in Delta Outflow are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 3 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-4 through 5-6 for Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in figures 5-13 through 5-16 for completeness. Results for changes in SWP and CVP reservoir storages are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Trinity Lake

Average annual end of September Trinity Lake storage would decrease by 33 TAF (3%) compared to the No Action Alternative and exhibit a decrease in about 75% of the years, as shown in Figure 5-6.

Average annual end of September Trinity Lake storage would decrease by 263 TAF (19%) compared to Existing Conditions and exhibit a decrease in almost all of the years, as shown in Figure 5-6. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 3 and the results show that average annual end of September Trinity Lake storage would decrease under Alternative 3 as compared to the conditions without the project.

Shasta Lake

Average annual end of September Shasta Lake storage would increase by 42 TAF (2%) compared to the No Action Alternative and exhibit an increase in about 60% of the years, as shown in Figure 5-8.

Average annual end of September Shasta Lake storage would decrease by 439 TAF (16%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-8. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 3 and the results show that average annual end of September Shasta Lake storage would increase under Alternative 3 as compared to the conditions without the project.

Lake Oroville

Average annual end of September Lake Oroville storage would increase by 349 TAF (25%) compared to the No Action Alternative and exhibit an increase in almost all of the years, as shown in Figure 5-10.

Average annual end of September Lake Oroville storage would decrease by 298 TAF (14%) compared to Existing Conditions and exhibit a decrease in about 90% of the years, as shown in Figure 5-10. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 3 and the results show that average annual end of September Lake Oroville storage would increase under Alternative 3 as compared to the conditions without the project.

Folsom Lake

Average annual end of September Folsom Lake storage would increase by 18 TAF (5%) compared to the No Action Alternative and exhibit an increase in about 75% of the years, as shown in Figure 5-12.

Average annual end of September Folsom Lake storage would decrease by 128 TAF (24%) compared to Existing Conditions and exhibit a decrease in about 90% of the years, as shown in Figure 5-12. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 3 and the results show that average annual end of September Folsom Lake storage would increase under Alternative 3 as compared to the conditions without the project.

Change in Delta exports

Changes in average annual Delta exports under Alternative 3 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-17 through 5-19 and Tables 5-4 through 5-6.

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 3 provide operational flexibility that would allow the SWP and CVP to increase Delta exports compared to operations under Existing Conditions and the No Action Alternative.

Monthly Delta export patterns are presented in Figures 5-21 through 5-29. Results for changes in Delta exports are presented in more detail in Appendix 5A BDCP EIR/S Modeling.

Change in SWP and CVP Deliveries

Changes in SWP and CVP deliveries under Alternative 3 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 3, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

CEQA Conclusion**:** Constructing Alternative 3 water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 3 would provide operational flexibility that would allow the SWP and CVP to increase Delta exports and resulting south of Delta water deliveries compared to deliveries under Existing Conditions and the No Action Alternative. However, these incremental changes reflect changes in operations due to Alternative 3 and due to SWP and CVP operations with increased north-of Delta urban demands, and sea level rise and climate change that would occur without implementation of Alternative 3. Therefore, the net incremental changes in deliveries under Alternative 3 as compared to Existing Conditions would be caused by the facility and operations assumptions of Alternative 3, (such as north Delta intakes capacity of 6,000 cfs and no Fall X2 or San Joaquin River Inflow-Export Ratio), increased north-of Delta urban demands, and changes in sea level rise and climate change.

Results for SWP and CVP deliveries are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Total CVP Deliveries

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 3 would increase by 258 TAF (6%) and 234 TAF (12%), respectively as compared to deliveries under No Action Alternative.

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 3 would increase by 86 TAF (2%) and decrease by 46 TAF (2%) as compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total CVP south of Delta deliveries would increase under Alternative 3 as compared to the deliveries under the No Action

Alternative. Therefore, average annual total CVP south of Delta deliveries would increase under Alternative 3 as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Average annual CVP north of Delta agricultural deliveries would increase by 17 TAF (11%) compared to the No Action Alternative under Alternative 3.

Average annual CVP north of Delta agricultural deliveries would be reduced by 56 TAF (24%) compared to Existing Conditions. This decrease primarily would occur due to sea level rise and climate change. Sea level rise and climate change require additional water to be released from CVP reservoirs to meet Delta water quality requirements.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta agricultural deliveries would increase under Alternative 3 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta agricultural deliveries would increase under Alternative 3 as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Average annual CVP south of Delta agricultural deliveries would increase by 223 TAF (31%) compared to the No Action Alternative.

Average annual CVP south of Delta agricultural deliveries would be reduced by 17 TAF (2%) compared to Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta agricultural deliveries would increase under Alternative 3 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta agricultural deliveries would increase under Alternative 3 as compared to the conditions without the project.

CVP Settlement and Exchange Contract Deliveries

CVP Settlement Contract deliveries during dry and critical years under Alternative 3 would be similar (less than 1% change) to deliveries under the No Action Alternative.

CVP Exchange Contractor deliveries during dry and critical years under Alternative 3 would be similar (less than 1% change) to deliveries under the No Action Alternative.

There would be an average annual decrease of 57 TAF (3%) in CVP Settlement Contract deliveries during dry and critical years under Alternative 3 as compared deliveries under Existing Conditions. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

CVP Exchange Contractor deliveries during dry and critical years under Alternative 3 would be similar (less than 1% change) to deliveries under the Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract and CVP Exchange Contractor deliveries during dry and critical years would be similar under Alternative 3 as compared to the deliveries under the No Action Alternative. Therefore, CVP Settlement Contract and CVP Exchange Contractor deliveries during dry and critical years would be similar under Alternative 3 as compared to the conditions without the project.

CVP North of Delta Municipal and Industrial Deliveries

Average annual CVP north of Delta M&I deliveries would increase 3 TAF (1% change) as compared to deliveries under the No Action Alternative. Alternative 3 north of Delta M&I deliveries increase in about 10% of the years compared to the No Action Alternative, as shown in Figure 5-32.

Average annual CVP north of Delta M&I deliveries would increase by 174 TAF (83%) as compared to deliveries under Existing Conditions. Alternative 3 north of Delta M&I deliveries increase in all years compared to Existing Conditions, as shown in Figure 5-32. These changes primarily would occur because there would be an increase in north of Delta M&I water rights demands under both Alternative 3 and No Action Alternative as compared to Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP north of Delta M&I deliveries would increase under Alternative 3 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries would increase under Alternative 3 as compared to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Average annual CVP south of Delta M&I deliveries would increase by 10 TAF (10%) compared to the No Action Alternative. Alternative 3 south of Delta M&I deliveries would increase in about 60% of the years compared to the No Action Alternative, as shown in Figure 5-33.

Average annual CVP south of Delta M&I deliveries would decrease about 3 TAF (2%) as compared to deliveries under Existing Conditions. Alternative 3 south of Delta M&I deliveries would increase in about 40% of the years and would decrease in about 40% of the years compared to Existing Conditions, as shown in Figure 5-33.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta M&I deliveries would increase under Alternative 3 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta M&I deliveries would increase under Alternative 3 as compared to the conditions without the project.

Total SWP Deliveries

Average annual total SWP deliveries, including Table A (including Article 56) plus Article 21 deliveries, and average annual total south of the Delta SWP deliveries under Alternative 3 would increase by 686 TAF (21%) and 668 TAF (29%) as compared to deliveries under No Action Alternative. Alternative 3 south of the Delta SWP deliveries would increase in about 80% of the years and would be similar in about 20% of the years compared to the No Action Alternative, as shown in Figure 5-34.

Average annual total SWP deliveries and average annual total south of the Delta SWP deliveries under Alternative 3 would increase by 292 TAF (8%) and 298 TAF (11%) as compared to deliveries under existing Conditions. Alternative 3 south of the Delta SWP deliveries would increase in about 65% of the years and would decrease in about 35% of the years compared to Existing Conditions, as shown in Figure 5-34.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total south of the Delta SWP deliveries would increase under Alternative 3 as compared to the deliveries under the No Action Alternative. Therefore, average annual total south of the Delta SWP deliveries would increase under Alternative 3 as compared to the conditions without the project.

SWP Table A Deliveries

Average annual SWP Table A deliveries with Article 56 (without Article 21) under Alternative 3 increase 519 TAF (22%)under Alternative 3 compared to the No Action Alternative and average annual SWP south of Delta Table A deliveries increase 505 TAF (22%) compared to the No Action Alternative. Alternative 3 SWP Table A deliveries would increase in about 80% of the years and would be similar in about 20% of the years compared to the No Action Alternative, as shown in Figure 5-35.

Average annual SWP Table A deliveries with Article 56 (without Article 21) under Alternative 3 increase by about 256 TAF (10%) compared to Existing Conditions and average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) increase by about 230 TAF (9%) compared to Existing Conditions. Alternative 3 SWP Table A deliveries would increase in about 65% of the years and would decrease in about 35% of the years compared to Existing Conditions, as shown in Figure 5-35.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP south of Delta Table A deliveries would increase under Alternative 3 as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP south of Delta Table A deliveries would increase under Alternative 3 as compared to the conditions without the project.

SWP Article 21 Deliveries

Average annual SWP Article 21 deliveries would increase 162 TAF (343%) as compared to the No Action Alternative. The frequency and the amount of Alternative 3 Article 21 deliveries would increase compared to the No Action Alternative, as shown in Figure 5-36.

Average annual SWP Article 21 deliveries would increase 51 TAF (32%) compared to Existing Conditions. The frequency of Alternative 3 Article 21 deliveries would increase compared to Existing Conditions, as shown in Figure 5-36.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Article 21 deliveries would increase under Alternative 3 as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP Article 21 deliveries would increase under Alternative 3 as compared to the conditions without the project.

Feather River Service Area

There would be an average annual increase of 12 TAF (1%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 3 compared to deliveries under the No Action Alternative.

There would be an average annual decrease of 43 TAF (5%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 3 as compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries would increase under Alternative 3 as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP Feather River Service Area deliveries would increase under Alternative 3 as compared to the conditions without the project.

NEPA Effects: Overall, SWP and CVP deliveries would either not change or would increase under Alternative 3 as compared to deliveries under No Action Alternative. This comparison provides an indication of the changes due to Alternative 3 in the absence of the effects of increased north of delta demands and sea level rise and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 3 would decline as compared to deliveries under Existing Conditions The primary cause of the reduction is increased north-of-Delta water demands that would occur under Alternative 3 and changes in SWP and CVP operations due to sea level rise and climate change. As shown above in the NEPA analysis, SWP and CVP deliveries would either not change or would increase under Alternative 3 as compared to deliveries under conditions in 2060 without Alternative 3 if sea level rise and climate change conditions are considered the same under both scenarios. SWP and CVP deliveries under Alternative 3 would increase as compared to deliveries under Existing Conditions without the effects of increased north-of-Delta water demands, sea level rise, and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 3 increases the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to existing conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would decrease slightly, although the average volume of those transfers would increase. The demand for water transfers to supplement supply shortages is estimated to decrease from 52 percent of years to 46 percent of years compared to existing conditions, and the average annual cross-Delta transfers are estimated to increase from 146,000 acre-feet to about 200,000 acre-feet per year compared to existing conditions, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Alternative 3 increases project water supply allocations as compared to the No Action Alternative, and consequently will decrease cross-Delta water transfer demand compared to that alternative. The demand for water transfers to supplement supply shortages is estimated to decrease from 68 percent of years to 46 percent of years compared to the No Action Alternative, and the average annual volume of cross-Delta transfers is estimated to decrease from about 280,000 acre-feet per year to about 200,000 acre-feet per year compared to the No Action Alternative.

Alternative 3 provides a separate cross-Delta facility with additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including BDCP permit terms as discussed in Alternative 1A.

CEQA Conclusion: Alternative 3 would increase water transfer demand compared to existing conditions. Alternative 3 would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.9 Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H)

Facilities construction under Alternative 4 would be similar to those described for Alternative 2A with only three intakes. Alternative 4 water conveyance operations would follow the similar operational criteria as Alternative 2A with the exception of evaluating a range of possible operations for the spring and fall Delta outflow requirements that are considered to be equally likely. This range of operations are encompassed by four separate scenarios as described in detail in Section 3.6.4.2 in Chapter 3, *Description of Alternatives*, and in Appendix 5A, *BDCP EIR/S Modeling.* These four scenarios vary depending on assumptions for Delta outflow requirements in spring and fall.

Alternative 4 Operational Scenario H1 (Alternative 4 H1) does not include enhanced spring outflow requirements or Fall X2 requirements,

Alternative 4 Operational Scenario H2 (Alternative 4 H2) includes enhanced spring outflow requirements but not Fall X2 requirements,

Alternative 4 Operational Scenario H3 (Alternative 4 H3) does not include enhanced spring outflow requirements but includes Fall X2 requirements (similar to Alternative 2A), and

Alternative 4 Operational Scenario H4 (Alternative 4 H4) includes both enhanced spring outflow requirements and Fall X2 requirements.

A description of the changes in Delta outflow, reservoir storage, Delta exports, and SWP and CVP deliveries is provided below for each scenario. The results for Alternative 4 scenarios include sea level rise and climate change that would occur at late long-term [LLT] around Year 2060. As described in Section 5.3.1 Methods of Analysis, sea level rise and climate change affect SWP and CVP operations and require additional water to be released from SWP and CVP reservoirs to meet Delta water quality requirements.

Model simulation results for Alternative 4 (all scenarios) are summarized in Tables 5-7 through 5-9.

Summary of Water Supply Operations under Alternative 4

Change in Delta Outflow

Changes in average annual Delta outflow under Alternative 4 (all scenarios) as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-7 through 5-9.

Late-fall and winter outflows remain similar or show minor reductions in all four Alternative 4 scenarios compared to No Action Alternative. In the spring months, outflow would decrease under scenarios H1 and H3 as compared to No Action Alternative, while the enhanced spring outflow requirement under scenarios H2 and H4 would result in increased or similar outflow compared to No Action Alternative. SWP and CVP exports in summer months would increase and result in lower outflow under all four scenarios compared to No Action Alternative. In the fall months, outflow would be decreased under Alternative 4 H1 and H2 compared to No Action Alternative, while it would be increasing or remaining similar under scenarios H3 and H4 because of the Fall X2 requirement, in wet and above-normal years. All four scenarios would show increased or similar outflow in September and October months of all year types because of OMR flow requirements and export reductions.

Long-term average and wet year peak outflows would increase in winter months with a corresponding decrease in spring months because of the shift in system inflows caused by climate change and increased Delta exports as compared to Existing Conditions. In other year types, scenarios H1 and H3 would result in lower or similar outflow in the spring months, while scenarios H2 and H4 would result in higher or similar outflow, because of the enhanced spring outflow requirements. In summer and fall months, all four scenarios would result in similar or higher outflow because of changes in export patterns and OMR flow requirements and export reductions in fall months, and also because of the Fall X2 requirements in scenarios H3 and H4 in wet and above normal years. The incremental changes in Delta outflow between Alternative 4 (all scenarios) and Existing Conditions would be a function of both the facility and operations assumptions of Alternative 4 scenarios (including north Delta intakes capacity of 9,000 cfs, less negative OMR flow requirements, enhanced spring outflow and/or Fall X2 requirements) and the reduction in water supply availability due to increased north of Delta urban demands, sea level rise and climate change.

Based on results from all four possible outcomes of the Alternative 4, Delta outflow under Alternative 4 (all scenarios) would likely decrease or remain similar compared to the conditions without the project.

Results for changes in Delta Outflow are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 4 (all scenarios) as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-7 through 5-9 for Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in figures 5-13 through 5-16 for completeness. Results for changes in SWP and CVP reservoir storages are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Trinity Lake

Under Alternative 4 scenarios, average annual end of September Trinity Lake storage as compared to No Action Alternative would range from a decrease of 24 TAF (2%) in about 70% of the years under H3 scenario to an increase of 23 TAF (2%) in about 75% of the years under H2 scenario, as shown in Figure 5-6.

Under Alternative 4 scenarios, average annual end of September Trinity Lake storage as compared to Existing Conditions would range from a decrease of 255 TAF (18%) in almost all of the years under H3 scenario to a decrease of 207 TAF (15%) in almost all of the years under H2 scenario, as shown in Figure 5-6. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 4 and the results show that average annual end of September Trinity Lake storage could decrease or increase under Alternative 4 as compared to the conditions without the project.

Shasta Lake

Under Alternative 4 scenarios, average annual end of September Shasta Lake storage as compared to No Action Alternative would range from a decrease of 60 TAF (3%) in about 75% of the years under H3 scenario to an increase of 142 TAF (6%) in about 90% of the years under H2 scenario, as shown in Figure 5-8.

Under Alternative 4 scenarios, average annual end of September Shasta Lake storage as compared to Existing Conditions would range from a decrease of 541 TAF (20%) about 95% of the years under H3 scenario to a decrease of 339 TAF (12%) in about 95% of the years under H2 scenario, as shown in Figure 5-8. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 4 and the results show that average annual end of September Shasta Lake storage could decrease or increase under Alternative 4 as compared to the conditions without the project.

Lake Oroville

Under Alternative 4 scenarios, average annual end of September Lake Oroville storage as compared to No Action Alternative would range from an increase of 66 TAF (5%) in about 90% of the years under H3 scenario to an increase of 305 TAF (22%) in almost all of the years under H2 scenario, as shown in Figure 5-10.

Under Alternative 4 scenarios, average annual end of September Lake Oroville storage as compared to Existing Conditions would range from a decrease of 580 TAF (28%) in almost all of the years under H3 scenario to a decrease of 341 TAF (17%) in about 95% of the years under H2 scenario, as shown in Figure 5-10. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 4 and the results show that average annual end of September Lake Oroville storage would increase under Alternative 4 as compared to the conditions without the project.

Folsom Lake

Under Alternative 4 scenarios, average annual end of September Folsom Lake storage as compared to No Action Alternative would range from a decrease of 8 TAF (2%) in about 55% of the years under H3 scenario to an increase of 43 TAF (11%) in about 90% of the years under H2 scenario, as shown in Figure 5-12.

Under Alternative 4 scenarios, average annual end of September Folsom Lake storage as compared to Existing Conditions would range from a decrease of 154 TAF (29%) about 95% of the years under H3 scenario to a decrease of 103 TAF (20%) in about 90% of the years under H2 scenario, as shown in Figure 5-12. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 4 and the results show that average annual end of September Folsom Lake storage could decrease or increase under Alternative 4 as compared to the conditions without the project.

Change in Delta Exports

Changes in average annual Delta exports under Alternative 4 scenarios as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-17 through 5-20 and Tables 5-7 through 5-9.

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 4 scenarios change SWP and CVP Delta exports as compared to Delta exports under Existing Conditions and the No Action Alternative.

Delta exports would either remain similar or increase under Alternative 4 scenarios as compared to exports under No Action Alternative depending on the implementation of Fall X2 and/or enhanced spring outflow requirement. The increase in exports is mainly because of the additional capability to divert water at the north Delta intakes during winter and spring months.

Total long-term average annual Delta exports under Alternative 4 scenarios would decrease as compared to exports under Existing Conditions reflecting changes in operations due to less negative OMR flows, implementation of Fall X2 and/or enhanced spring outflow under Alternative 4 scenarios, and sea level rise and climate change.

The incremental change in Delta exports under Alternative 4 scenarios as compared to No Action Alternative would be caused by the facility and operations assumptions of Alternative 4 scenarios (such as north Delta intakes capacity of 9,000 cfs, Head of Old River Barrier operations and less negative OMR flows, enhanced spring outflow and Fall X2) only. Delta exports would either remain similar or increase under Alternative 4 scenarios as compared to the conditions without the project.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 4, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

***CEQA Conclusion*:** Constructing Alternative 4 water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The addition of the north Delta intakes and changes to Delta regulatory requirements under all four Alternative 4 scenarios provide operational flexibility compared to deliveries under Existing Conditions and the No Action Alternative.

Results for SWP and CVP deliveries are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Total CVP Deliveries

Under Alternative 4 scenarios, the change in average annual total CVP deliveries as compared to No Action Alternative, would range from an increase of 83 TAF (2%) under H4 scenario to 251 TAF (6%) under H1 scenario. Under the four Alternative 4 scenarios, the change in average annual total south of Delta CVP deliveries as compared to No Action Alternative, would range from an increase of 73 TAF (4%) under H4 scenario to 221 TAF (11%) under H1 scenario.

Under Alternative 4 scenarios, the change in average annual total CVP deliveries as compared to Existing Conditions, would range from a decrease of 90 TAF (2%) under H4 scenario to an increase of 79 TAF (2%) under H1 scenario. Under Alternative 4 scenarios, the change in average annual total south of Delta CVP deliveries as compared to Existing Conditions, would range from a decrease of 59 TAF (3%) under H1 scenario to 207 TAF (9%) under H4 scenario.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4 scenarios in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that under Alternative 4 scenarios average annual total CVP deliveries would increase by up to 251 TAF (6%) and average annual total south of Delta CVP deliveries would increase by up to 221 TAF (11%) as compared to No Action Alternative. Therefore, average annual total CVP deliveries and average annual total CVP south of Delta deliveries would increase under Alternative 4 scenarios as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Under Alternative 4 scenarios, the change in average annual CVP north of Delta agricultural deliveries as compared to No Action Alternative, would range from an increase of 1 TAF (1%) under

H4 scenario to 19 TAF (12%) under H1 scenario. Compared to No Action Alternative, the scenarios H1 and H2 would exhibit similar or increased CVP north of Delta agricultural deliveries in most years, including about 10% of dry years, while scenarios H3 and H4 would exhibit in similar deliveries in most years, as shown in Figure 5-30.

Under Alternative 4 scenarios, the change in average annual CVP north of Delta agricultural deliveries as compared to Existing Conditions, would range from a decrease of 54 TAF (23%) under H1 scenario to 72 TAF (31%) under H4 scenario. Compared to Existing Conditions, all four Alternative 4 scenarios exhibit lower CVP north of Delta agricultural deliveries in about 80% years, as shown in Figure 5-30. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4 scenarios in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta agricultural deliveries as compared to No Action Alternative would increase by up to 19 TAF (12%) under Alternative 4 scenarios. Therefore, average annual CVP north of Delta agricultural deliveries would increase under Alternative 4 scenarios as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Under Alternative 4 scenarios, the change in average annual CVP south of Delta agricultural deliveries as compared to No Action Alternative, would range from an increase of 69 TAF (9%) under H4 scenario to 213 TAF (29%) under H1 scenario. Compared to No Action Alternative, the Scenarios H1 and H2 would exhibit increased CVP south of Delta agricultural deliveries in most years, while scenarios H3 and H4 would exhibit increased deliveries in about 50% years and similar deliveries in remaining years, as shown in Figure 5-31.

Under Alternative 4 scenarios, the change in average annual CVP south of Delta agricultural deliveries as compared to Existing Conditions, would range from a decrease of 27 TAF (3%) under H1 scenario to 171 TAF (18%) under H4 scenario. Compared to Existing Conditions, the scenarios H1 and H2 would exhibit increased CVP south of Delta agricultural deliveries in about 50% years, while lower deliveries in the remaining years. The scenarios H3 and H4 exhibit similar deliveries in about 30% years, and lower deliveries in the remaining years, as shown in Figure 5-31. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4 scenarios in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta agricultural deliveries as compared to No Action Alternative would increase by up to 213 TAF (29%) under Alternative 4 scenarios. Therefore, average annual CVP south of Delta agricultural deliveries would increase under Alternative 4 scenarios as compared to the conditions without the project.

CVP Settlement and Exchange Contract Deliveries

There would be negligible change to CVP Settlement Contract deliveries during dry and critical years under all four Alternative 4 scenarios as compared to deliveries under the No Action Alternative, with scenarios H1 and H3 showing no change (or less than 1% change) and with scenarios H2 and H4 showing about 23 TAF (1%) increase.

Under Alternative 4 scenarios, the change in CVP Settlement Contract deliveries during dry and critical years as compared to Existing Conditions, would range from a decrease of 29 TAF (2%) under H4 scenario to 59 TAF (3%) under H3 scenario. This is due to Shasta Lake storage declining to dead pool more frequently, as described previously, under increased north-of Delta demands and climate change and sea level rise conditions. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

There would be no changes in deliveries to CVP Exchange Contractors under Alternative 4 scenarios.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4 scenarios in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years would remain similar (or less than 1% change) or increase by up to 23 TAF (1%) under Alternative 4 scenarios as compared to the deliveries under the No Action Alternative. Therefore, CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years under Alternative 4 scenarios would be similar to the deliveries under the conditions without the project.

CVP North of Delta Municipal and Industrial Deliveries

Under Alternative 4 scenarios, the change in average CVP north of Delta M&I deliveries as compared to No Action Alternative, would range from an increase of 1 TAF (or less than 1% change) under H3 and H4 scenarios to 7 TAF (2%) under H1 scenario. Compared to No Action Alternative, the scenarios H1, H2, H3 and H4 would exhibit similar deliveries in all years, as shown in Figure 5-32.

Under Alternative 4 scenarios, the change in average annual CVP north of Delta M&I deliveries as compared to Existing Conditions, would range from an increase of 172 TAF (82%) under H3 ad H4 scenarios to 178 TAF (85%) under H1 scenario. Compared to Existing Conditions, the 4 scenarios H1, H2, H3 and H4 would exhibit higher deliveries in all years, as shown in Figure 5-32. However, this increase primarily would occur because there would be an increase in north of Delta M&I water rights demands under Alternative 4 scenarios and No Action Alternative as compared to demands under Existing Conditions.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4 scenarios in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries would remain similar or increase by up to 7 TAF (2%) under Alternative 4 scenarios as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries would increase under Alternative 4 scenarios as compared to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Under Alternative 4 scenarios, the change in average CVP south of Delta M&I deliveries as compared to No Action Alternative, would range from an increase of 4 TAF (4%) under H3 and H4 scenarios to 9 TAF (9%) under H1 and H2 scenarios. Compared to No Action Alternative, the Scenarios H1 and H2 exhibit increased deliveries in about 60% of the years, while scenarios H3 and H4 would exhibit increased deliveries in about 20% of the wetter years, and all scenarios exhibit similar deliveries in the remaining years, as shown in Figure 5-33.

Under Alternative 4 scenarios, the change in average annual CVP south of Delta M&I deliveries as compared to Existing Conditions, would range from a decrease of 4 TAF (3%) under H1 and H2 scenarios to 9 TAF (7%) under H4 scenario. Compared to Existing Conditions, the scenarios H1, H2, H3 and H4 would exhibit higher or similar deliveries in about 60% of the years and lower deliveries in the remaining, as shown in Figure 5-33. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4 scenarios in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta M&I deliveries would remain similar or increase by up to 9 TAF (9%) under Alternative 4 scenarios as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta M&I deliveries would increase under Alternative 4 scenarios as compared to the conditions without the project.

Total SWP Deliveries

Under Alternative 4 scenarios, the change in average annual total SWP deliveries as compared to No Action Alternative, would range from a decrease of 91 TAF (3%) under H4 scenario to an increase of 582 TAF (17%) under H1 scenario. Under Alternative 4 scenarios, the change in average annual total south of the Delta SWP deliveries, including Table A (including Article 56) plus Article 21 deliveries, as compared to No Action Alternative, would range from a decrease of 94 TAF (4%) under H4 scenario to an increase of 566 TAF (24%) under H1 scenario. Compared to No Action Alternative, the scenarios H1 and H3 exhibit increased deliveries in about 70% of the years and similar deliveries in remaining years, while scenarios H2 and H4 would exhibit increased deliveries in about 30% of the wetter years. Scenario H2 exhibits similar deliveries and scenario H4 exhibits lower deliveries in the remaining years, as shown in Figure 5-34.

Under Alternative 4 scenarios, the change in average annual total SWP deliveries as compared to Existing Conditions, would range from a decrease of 485 TAF (13%) under H4 scenario to an increase of 187 TAF (5%) under H1 scenario. Under Alternative 4 scenarios, the change in average annual total south of the Delta SWP deliveries, including Table A (including Article 56) plus Article 21 deliveries, as compared to Existing Conditions, would range from a decrease of 464 TAF (17%) under H4 scenario to an increase of 196 TAF (7%) under H1 scenario. Compared to Existing Conditions, the Scenarios H1 and H3 exhibit increased deliveries in about 60% of the years and lower deliveries in remaining years, while scenarios H2 and H4 would exhibit increased deliveries in about 20% of the wetter years and lower deliveries in the remaining years, as shown in Figure 5-34.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4 scenarios without the effects of sea level rise and climate change and the results show that under Alternative 4 scenarios average annual total SWP deliveries would decrease by up to 91 TAF (3%) or increase by up to 582 TAF (17%) and average annual total south of Delta SWP deliveries would decrease by up to 94 TAF (4%) or increase by up to 566 TAF (24%) as compared to No Action Alternative. Therefore, average annual total SWP deliveries and average annual total SWP south of Delta deliveries under Alternative 4 scenarios would show a small decrease or an increase as compared to the conditions without the project.

SWP Table A Deliveries

Under Alternative 4 scenarios, the change in average annual total SWP Table A deliveries with Article 56 (without Article 21) as compared to No Action Alternative, would range from a decrease of 175 TAF (7%) under H4 scenario to an increase of 489 TAF (21%) under H1 scenario. Under Alternative 4 scenarios, the change in average annual total south of the Delta SWP Table A deliveries with Article 56 (without Article 21), as compared to No Action Alternative, would range from a decrease of 171 TAF (7%) under H4 scenario to an increase of 475 TAF (21%) under H1 scenario. Compared to No Action Alternative, the Scenarios H1 and H3 exhibit increased deliveries in about 70% of the years and similar deliveries in remaining years, while scenarios H2 and H4 would exhibit increased deliveries in about 20% of the wetter years. In the remaining years, scenario H3 exhibits similar deliveries and scenario H4 exhibits lower deliveries, as shown in Figure 5-35.

Under Alternative 4 scenarios, the change in average annual total SWP Table A deliveries with Article 56 (without Article 21) as compared to Existing Conditions, would range from a decrease of 438 TAF (17%) under H4 scenario to an increase of 226 TAF (9%) under H1 scenario. Under Alternative 4 scenarios, the change in average annual total south of the Delta SWP Table A deliveries with Article 56 (without Article 21), as compared to Existing Conditions, would range from a decrease of 446 TAF (17%) under H4 scenario to an increase of 201 TAF (8%) under H1 scenario. Compared to Existing Conditions, the Scenarios H1 and H3 exhibit increased deliveries in about 60% of the years and lower deliveries in remaining years, while scenarios H2 and H4 would exhibit increased deliveries in about 20% of the wetter years and lower deliveries in the remaining years, as shown in Figure 5-35.

Deliveries under the No Action Alternative are an indication of the potential change due to Alternative 4 scenarios in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that under Alternative 4 scenarios average annual total SWP Table A deliveries with Article 56 (without Article 21) would decrease by up to 175 TAF (7%) or increase by up to 489 TAF (21%) and average annual total south of Delta SWP Table A deliveries with Article 56 (without Article 21) would decrease by up to 171 TAF (7%) or increase by up to 475 TAF (21%) as compared to No Action Alternative. Therefore, average annual total SWP Table A deliveries with Article 56 (without Article 21) and average annual total SWP south of Delta Table A deliveries with Article 56 (without Article 21) would show a small decrease or an increase under Alternative 4 scenarios as compared to the conditions without the project.

SWP Article 21 Deliveries

Under Alternative 4 scenarios, the change in average annual total SWP Article 21 deliveries as compared to No Action Alternative, would range from an increase of 60 TAF (126%) under H3 scenario to 91 TAF (192%) under H1 and H2 scenarios. Compared to No Action Alternative, the Scenarios H1, H2 H3 and H4 exhibit increased deliveries in about same number of years as in No Action Alternative, although increased SWP Article 21 deliveries are observed in about all 40% of the years where Article 21 deliveries are made(Figure 5-36).

Under Alternative 4 scenarios, the change in average annual total SWP Article 21 deliveries as compared to Existing Conditions, would range from a decrease of 20 TAF (13%) under H1 and H2 scenarios to 51 TAF (32%) under H3 scenario. Compared to Existing Conditions, the Scenarios H1, H2, H3 and H4 exhibit similar or decreased deliveries in about same number of years as in Existing Conditions, as shown in Figure 5-36.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4 scenarios in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual Article 21 deliveries would increase by up to 91 TAF (192%) under Alternative 4 scenarios as compared to the deliveries under the No Action Alternative. Therefore, average annual Article 21 deliveries would increase under Alternative 4 scenarios as compared to the conditions without the project.

SWP Feather River Service Area

Under Alternative 4 scenarios, the change in average annual total SWP Feather River Service Area deliveries during dry and critical years as compared to No Action Alternative, would range from an increase of 5 TAF (1%) under H1 and H3 scenarios to 17 TAF (2%) under H4 scenario.

Under Alternative 4 scenarios, the change in average annual total SWP Feather River Service Area deliveries during dry and critical years as compared to Existing Conditions, would range from a decrease of 38 TAF (4%) under H4 scenario to 50 TAF (6%) under H1 and H3 scenarios. The primary cause of this reduction would be change in SWP operations due to sea level rise and climate change.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4 scenarios in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries would increase by up to 17 TAF (2%) under Alternative 4 scenarios as compared to the deliveries under No Action Alternative. Therefore, average annual SWP Feather River Service Area deliveries would increase under Alternative 4 scenarios as compared to the conditions without the project.

NEPA Effects: SWP and CVP deliveries under Alternative 4 as compared to deliveries under No Action Alternative would increase. Indirect effects of changes in water deliveries in addition to potential effects on urban areas caused by changes in SWP and CVP water supply deliveries, are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 4 would decline as compared to deliveries under Existing Conditions. The primary cause of the reduction is increased north of Delta water demands that would occur under No Action Alternative and Alternative 4 and changes in SWP and CVP operations due to sea level rise and climate change. As shown above in the NEPA analysis, SWP and CVP deliveries would generally increase under Alternative 4 as compared to deliveries under conditions in 2060 without Alternative 4 if sea level rise and climate change conditions are considered the same under both scenarios. SWP and CVP deliveries under Alternative 4 would generally increase as compared to deliveries under Existing Conditions without the effects of increased north of Delta water demands, sea level rise, and climate change. Some reductions in the SWP south of Delta deliveries could occur under the Alternative 4 scenarios with enhanced spring outflow. Indirect effects of changes in water deliveries in addition to potential effects on urban areas caused by changes in SWP and CVP water supply deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 4 increases project water supply allocations as compared to the No Action Alternative, and consequently will decrease cross-Delta water transfer demand compared to that alternative. The four scenarios under Alternative 4 would change the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to existing conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would change as well, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

For Scenario H1 compared to existing conditions, the frequency of years in which cross-Delta transfers would decrease from 52% to 49%, and the average annual volume of those transfers would increase from 146,000 acre-feet to 187,000 acre-feet. For Scenario H1 compared to the No Action Alternative, the frequency of years in which cross-Delta transfers would decrease from 68% to 49%, the average annual volume of those transfers would decrease from 280,000 acre-feet to 187,000 acre-feet.

For Scenario H2 compared to existing conditions, the frequency of years in which cross-Delta transfers would increase from 52% to 55%, and the average annual volume of those transfers would increase from 146,000 acre-feet to 212,000 acre-feet. For Scenario H2 compared to the No Action Alternative, the frequency of years in which cross-Delta transfers would decrease from 68% to 55%, the average annual volume of those transfers would decrease from 280,000 acre-feet to 212,000 acre-feet.

For Scenario H3 compared to existing conditions, the frequency of years in which cross-Delta transfers would increase from 52% to 57%, and the average annual volume of those transfers would increase from 146,000 acre-feet to 227,000 acre-feet. For Scenario H3 compared to the No Action Alternative, the frequency of years in which cross-Delta transfers would decrease from 68% to 57%, the average annual volume of those transfers would decrease from 280,000 acre-feet to 227,000 acre-feet.

For Scenario H4 compared to existing conditions, the frequency of years in which cross-Delta transfers would increase from 52% to 66%, and the average annual volume of those transfers would increase from 146,000 acre-feet to 279,000 acre-feet. For Scenario H4 compared to the No Action Alternative, the frequency of years in which cross-Delta transfers would decrease from 68% to 66%, the average annual volume of those transfers would decrease from 280,000 acre-feet to 279,000 acre-feet.

Alternative 4 provides a separate cross-Delta facility with additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including BDCP permit terms as discussed in Alternative 1A.

CEQA Conclusion: Alternative 4 would increase water transfer demand compared to existing conditions. Alternative 4 would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.10 Alternative 5—Dual Conveyance with Pipeline/Tunnel and Intake 1 (3,000 cfs; Operational Scenario C)

Facilities construction under Alternative 5 would be similar to those described for Alternative 1A with only one intake. Alternative 5 water conveyance operations would follow the operational criteria described as Scenario C. These operations criteria are described in detail in Section 3.6.4.2 in Chapter 3, *Description of Alternatives*, and in Appendix 5A, *BDCP EIR/S Modeling.*

Changes in Delta outflow, reservoir storage, Delta exports, and SWP and CVP deliveries is provided below. The results for Alternative 5 include sea level rise and climate change that would occur at late long-term [LLT] around Year 2060. As described in Section 5.3.1, *Methods of Analysis*, sea level rise and climate change affect SWP and CVP operations and require additional water to be released from SWP and CVP reservoirs to meet Delta water quality requirements.

Summary of Water Supply Operations under Alternative 5

Change in Delta Outflow

Changes in average annual Delta outflow under Alternative 5 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Long-term average and wet year Delta outflows decrease in January through May and July and August under Alternative 5 compared to the No Action Alternative. The decrease in outflow would be attributable to the increase in SWP and CVP exports. The timing of seasonal outflows in dry year types would be similar to No Action Alternative.

The incremental changes in Delta outflow between Alternative 5 and Existing Conditions would be a function of both the facility and operations assumptions of Alternative 5 (including north Delta intakes capacity of 3,000 cfs, and Fall X2) and the reduction in water supply availability due to increased north-of Delta demands and sea level rise and climate change.

Results for changes in Delta Outflow are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 5 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-4 through 5-6 for Trinity Lake, Shasta lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in Figures 5-13 through 5-16 for completeness. Results for changes in SWP and CVP reservoir storages are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Trinity Lake

Average annual end of September Trinity Lake storage would decrease by 20 TAF (2%) compared to the No Action Alternative and exhibit a decrease in about 75% of the years, as shown in Figure 5-6.

Average annual end of September Trinity Lake storage would decrease by 250 TAF (18%) compared to Existing Conditions and exhibit a decrease in almost all of the years, as shown in Figure 5-6. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 5 and the results show that average annual end of September Trinity Lake storage would decrease under Alternative 5 as compared to the conditions without the project.

Shasta Lake

Average annual end of September Shasta Lake storage would decrease by 53 TAF (2%) compared to the No Action Alternative and exhibit a decrease in about 75% of the years, as shown in Figure 5-8.

Average annual end of September Shasta Lake storage would decrease by 534 TAF (20%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-8. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 5 and the results show that average annual end of September Shasta Lake storage would decrease under Alternative 5 as compared to the conditions without the project.

Lake Oroville

Average annual end of September Lake Oroville storage would increase by 130 TAF (9%) compared to the No Action Alternative and exhibit an increase in almost all of the years, as shown in Figure 5-10.

Average annual end of September Lake Oroville storage would decrease by 517 TAF (25%) compared to Existing Conditions and exhibit a decrease in almost all of the years, as shown in Figure 5-10. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 5 and the results show that average annual end of September Lake Oroville storage would increase under Alternative 5 as compared to the conditions without the project.

Folsom Lake

Average annual end of September Folsom Lake storage would decrease by 16 TAF (4%) compared to the No Action Alternative and exhibit an increase in about 70% of the years, as shown in Figure 5-12.

Average annual end of September Folsom Lake storage would decrease by 162 TAF (31%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-12. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 5 and the results show that average annual end of September Folsom Lake storage would increase under Alternative 5 as compared to the conditions without the project.

Change in Delta Exports

Changes in average annual Delta exports under Alternative 5 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-17 through 5-20 and Tables 5-4 through 5-6.

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 5 change SWP and CVP Delta exports as compared to Delta exports under Existing Conditions and the No Action Alternative. Delta exports would increase as compared to exports under No Action Alternative because of the additional capability to divert water at the north Delta intakes. Total long-term average annual Delta exports under Alternative 5 would decrease as compared to exports under Existing Conditions due to implementation of Fall X2, increased north of Delta demand and sea level rise and climate change. However, the incremental decrease as compared to Existing Conditions would reflect changes in operations due to Alternative 5 and due to SWP and CVP operations with sea level rise and climate change that would occur without implementation of Alternative 5.

Monthly Delta export patterns are presented in Figures 5-21 through 5-29. Results for changes in Delta exports are presented in more detail in Appendix 5A BDCP EIR/S Modeling.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 5, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

CEQA Conclusion**:** Constructing Alternative 5 water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The addition of the north Delta intake provides operational flexibility to the SWP and CVP to increase Delta exports during certain periods. However, these incremental changes reflect changes in operations due to Alternative 5 and due to SWP and CVP operations with sea level rise and climate change that would occur without implementation of Alternative 5. Therefore, the net incremental changes in deliveries under Alternative 5 as compared to Existing Conditions (discussed below) would be caused by the facility and operations assumptions of Alternative 5 (such as north Delta intake capacity of 3,000 cfs and Fall X2), increased north of Delta demand, and changes in sea level rise and climate change.

Results for SWP and CVP deliveries are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Total CVP Deliveries

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 5 would increase by 100 TAF (2%) and increase 100 TAF (5%), respectively as compared to deliveries under No Action Alternative.

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 5 would decrease by 72 TAF (2%) and decrease 180 TAF (8%) as compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 5 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total south of the Delta CVP deliveries would increase under Alternative 5 as compared to the deliveries under the No Action Alternative. Therefore, average annual total south of the Delta CVP deliveries would increase under Alternative 5 as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Average annual CVP north of Delta agricultural deliveries increase by 1 TAF (1%)under Alternative 5 compared to the deliveries under the No Action Alternative, and annual CVP north of Delta agricultural deliveries would be similar in almost all years, as shown in Figure 5-32.

Average annual CVP north of Delta agricultural deliveries would be reduced by 72 TAF (31%) compared to 1% of the years in the Existing Conditions, and annual CVP north of Delta agricultural deliveries would decrease in almost all years, as shown in Figure 5-32. However, this decrease primarily would occur due to increased north-of Delta demands and sea level rise and climate change. Sea level rise and climate change require additional water to be released from CVP reservoirs to meet Delta water quality requirements.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 5 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta agricultural deliveries would increase under Alternative 5 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta agricultural deliveries would increase under Alternative 5 as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Average annual CVP south of Delta agricultural deliveries would increase by 96 TAF (13%) compared to the No Action Alternative, and annual CVP south of Delta agricultural deliveries would increase in about 60% of the years and be similar in remaining years, as shown in Figure 5-33.

Average annual CVP south of Delta agricultural deliveries would be reduced by 144 TAF (15%) compared to 1% of the years in the Existing Conditions, and annual CVP south of Delta agricultural deliveries would be reduced about 90% of the years, as shown in Figure 5-33.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 5 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP south of Delta agricultural deliveries would increase under Alternative 5 as compared to the deliveries under the No Action Alternative.

Therefore, CVP south of Delta agricultural deliveries would increase under Alternative 5 as compared to the conditions without the project.

CVP Settlement and Exchange Contract Deliveries

CVP Settlement Contract deliveries during dry and critical years under Alternative 5 would be similar (less than 1% change) to deliveries under the No Action Alternative.

CVP Exchange Contractor deliveries during dry and critical years under Alternative 5 would be similar (less than 1% change) to deliveries under the No Action Alternative.

There would be an average annual decrease of 54 TAF (3%) in CVP Settlement Contract deliveries during dry and critical years under Alternative 5 as compared deliveries under Existing Conditions. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

CVP Exchange Contractor deliveries during dry and critical years under Alternative 5 would be similar (less than 1% change) to deliveries under the Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 5 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract and CVP Exchange Contractor deliveries would remain similar under Alternative 5 as compared to the deliveries under the No Action Alternative. Therefore, CVP Settlement Contract and CVP Exchange Contractor deliveries would remain similar under Alternative 5 as compared to the conditions without the project.

CVP North of Delta Municipal and Industrial Deliveries

Average annual CVP north of Delta M&I deliveries would be similar (less than 1% change) to deliveries under the No Action Alternative.

Average annual CVP north of Delta M&I deliveries would increase by 170 TAF (81%) as compared to deliveries under Existing Conditions. Alternative 5 north of Delta M&I deliveries increase in all years compared to Existing Conditions, as shown in Figure 5-34. These changes primarily would occur because there would be an increase in north of Delta M&I water rights demands under both Alternative 5 and No Action Alternative as compared to Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 5 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries would remain similar under Alternative 5 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries would remain similar under Alternative 5 as compared to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Average annual CVP south of Delta M&I deliveries would increase by 4 TAF (4%) compared to the No Action Alternative, where annual CVP south of Delta municipal and industrial deliveries would increase in about 30% of the years, as shown in Figure 5-35.

Average annual CVP south of Delta M&I deliveries would decrease about 9 TAF (7%) as compared to deliveries under Existing Conditions, where annual CVP south of Delta municipal and industrial deliveries would be reduced in about 50% of the years, as shown in Figure 5-35.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 5 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP south of Delta M&I deliveries would increase under Alternative 5 as compared to the deliveries under the No Action Alternative. Therefore, CVP south of Delta M&I deliveries would increase under Alternative 5 as compared to the conditions without the project.

Total SWP Deliveries

Average annual total SWP deliveries, including Table A (including Article 56) plus Article 21 deliveries, and average annual total south of the Delta SWP deliveries under Alternative 5 would increase by 255 TAF (8%) and 246 TAF (11%), respectively as compared to deliveries under No Action Alternative.

Average annual total SWP deliveries and average annual total south of the Delta SWP deliveries under Alternative 5 would decrease by 139 TAF (4%) and 124 TAF (5%) as compared to deliveries under Existing Conditions.

Changes in frequency of annual total south of the Delta SWP deliveries is provided in Figure 5-34 and changes in frequency of annual total SWP deliveries is provided in Appendix 5A, BDCP EIR/S Modeling.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 5 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total SWP deliveries and average annual total south of the Delta SWP deliveries would increase under Alternative 5 as compared to the deliveries under the No Action Alternative. Therefore, average annual total south of the Delta SWP deliveries would increase under Alternative 5 as compared to the conditions without the project.

SWP Table A Deliveries

Average annual SWP Table A deliveries with Article 56 (without Article 21) increase 222 TAF (9%) compared to the No Action Alternative and average annual SWP south of Delta Table A deliveries increase 215 TAF (9%) compared to the No Action Alternative. Alternative 5 annual SWP Table A deliveries would increase in about 65% of the years and be similar in remaining years compared to the No Action Alternative, as shown in Figure 5-35. Changes in frequency of annual SWP south of Delta Table A deliveries is provided in Appendix 5A, BDCP EIR/S Modeling.

Average annual SWP Table A deliveries with Article 56 (without Article 21) decrease by about 41 TAF (2%) compared to Existing Conditions and average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) decrease by about 59 TAF (2%) compared to Existing Conditions. Alternative 5 annual SWP Table A deliveries would increase in about 55% of the years and would be reduced in about 45% of the years compared to the Existing Conditions, as shown in Figure 5-35. Changes in frequency of annual SWP south of Delta Table A deliveries is provided in Appendix 5A, BDCP EIR/S Modeling.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 5 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP south of Delta Table A deliveries would increase under Alternative 5 as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP south of Delta Table A deliveries would increase under Alternative 5 as compared to the conditions without the project.

SWP Article 21 Deliveries

Average annual SWP Article 21 deliveries would increase 31 TAF (66%) as compared to the No Action Alternative. The frequency of Alternative 5 Article 21 deliveries would be similar to those under the No Action Alternative, although with increased amount of Article 21 deliveries, as shown in Figure 5-36.

Average annual SWP Article 21 deliveries would decrease 80 TAF (50%) compared to Existing Conditions. Both the frequency and amount of Alternative 5 Article 21 deliveries would be less than those under Existing Conditions, as shown in Figure 5-36.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 5 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Article 21 deliveries would increase under Alternative 5 as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP Article 21 deliveries would increase under Alternative 5 as compared to the conditions without the project.

Feather River Service Area

SWP Feather River Service Area deliveries would be similar (or less than 1% change) during dry and critical years under Alternative 5 as compared to deliveries under the No Action Alternative.

There would be an average annual decrease of 51 TAF (6%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 5 as compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 5 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that SWP Feather River Service Area deliveries would remain similar under Alternative 5 as compared to the deliveries under the No Action Alternative. Therefore, SWP Feather River Service Area deliveries would remain similar under Alternative 5 as compared to the conditions without the project.

NEPA Effects: Overall, SWP and CVP deliveries would increase under Alternative 5 as compared to deliveries under No Action Alternative. This comparison provides an indication of the changes due to Alternative 5 without the effects of sea level rise and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 5 would decline as compared to deliveries under Existing Conditions. As shown above in the NEPA analysis, SWP and CVP deliveries would increase under Alternative 5 as compared to deliveries under conditions in 2060 without Alternative 5 if sea level rise and climate change conditions are considered the same under both scenarios. SWP and CVP deliveries under Alternative 5 would increase as compared to deliveries under Existing Conditions without the effects of increased urban demand, sea level rise, and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 5 increases the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to existing conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would increase slightly, as well as the volume of those transfers. The demand for water transfers to supplement supply shortages is estimated to increase from 52 percent of years to 59 percent of years compared to existing conditions, and the average annual cross-Delta transfers are estimated to increase from 146,000 acre-feet to about 224,000 acre-feet per year compared to existing conditions, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Alternative 5 increases project water supply allocations as compared to the No Action Alternative, and consequently will decrease cross-Delta water transfer demand compared to that alternative. The demand for water transfers to supplement supply shortages is estimated to decrease from 68 percent of years to 59 percent of years compared to the No Action Alternative, and the average annual volume of cross-Delta transfers is estimated to decrease from about 280,000 acre-feet per year to about 224,000 acre-feet per year compared to the No Action Alternative.

Alternative 5 provides a separate cross-Delta facility with additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including BDCP permit terms as discussed in Alternative 1A.

CEQA Conclusion: Alternative 5 would increase water transfer demand compared to existing conditions. Alternative 5 would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.11 Alternative 6A—Isolated Conveyance with Pipeline/Tunnel and Intakes 1–5 (15,000 cfs; Operational Scenario D)

Facilities construction under Alternative 6A would be similar to those described for Alternative 1A. Alternative 6A water conveyance operations would follow the operational criteria described as Scenario D. These operations criteria are described in detail in Section 3.6.4.2 in Chapter 3, *Description of Alternatives*, and in Appendix 5A, *BDCP EIR/S Modeling.* A description of the changes in Delta outflow, reservoir storage, Delta exports, and SWP and CVP deliveries is provided below. The results for Alternative 6A include increased north of Delta demand, sea level rise and climate change that would occur at late long-term [LLT] around Year 2060. As described in Section 5.3.1 Methods of Analysis, sea level rise and climate change affect SWP and CVP operations and require additional water to be released from SWP and CVP reservoirs to meet Delta water quality requirements.

Summary of Water Supply Operations under Alternative 6A

Change in Delta Outflow

Changes in average annual Delta outflow under Alternative 6A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Long-term average, wet, and dry year outflows under Alternative 6 increase in October through January compared to those under the No Action Alternative due to the decrease in SWP and CVP exports because of elimination of the south Delta intakes.

The incremental changes in Delta outflow between Alternative 6A and Existing Conditions would be a function of both the facility and operations assumptions of Alternative 6A (including north Delta intakes capacity of 15,000 cfs, no south Delta intakes diversions, and Fall X2) and the reduction in water supply availability.

Results for changes in Delta Outflow are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 6A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-4 through 5-6 for Trinity Lake, Shasta lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in figures 5-13 through 5-16 for completeness. Results for changes in SWP and CVP reservoir storages are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Trinity Lake

Average annual end of September Trinity Lake storage would increase by 21 TAF (2%) compared to the No Action Alternative and exhibit a increase in about 60% of the years, as shown in Figure 5-6.

Average annual end of September Trinity Lake storage would decrease by 210 TAF (15%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-6. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 6A and the results show that average annual end of September Trinity Lake storage would increase under Alternative 6A as compared to the conditions without the project.

Shasta Lake

Average annual end of September Shasta Lake storage would increase by 72 TAF (3%) compared to the No Action Alternative and exhibit an increase in about 75% of the years, as shown in Figure 5-8.

Average annual end of September Shasta Lake storage would decrease by 409 TAF (15%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-8. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 6A and the results show that average annual end of September Shasta Lake storage would increase under Alternative 6A as compared to the conditions without the project.

Lake Oroville

Average annual end of September Lake Oroville storage would increase by 232 TAF (16%) compared to the No Action Alternative and exhibit an increase in almost all of the years, as shown in Figure 5-10.

Average annual end of September Lake Oroville storage would decrease by 414 TAF (20%) compared to Existing Conditions and exhibit a decrease in about 90% of the years, as shown in Figure 5-10. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 6A and the results show that average annual end of September Lake Oroville storage would increase under Alternative 6A as compared to the conditions without the project.

Folsom Lake

Average annual end of September Folsom Lake storage would increase by 20 TAF (5%) compared to the No Action Alternative and exhibit an increase in about 70% of the years, as shown in Figure 5-12.

Average annual end of September Folsom Lake storage would decrease by 126 TAF (24%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-12. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 6A and the results show that average annual end of September Folsom Lake storage would increase under Alternative 6A as compared to the conditions without the project.

Change in Delta exports

Changes in average annual Delta exports under Alternative 6A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-17 through 5-20 and Tables 5-4 through 5-6.

The elimination of diversions at the south Delta intakes reduces operational flexibility and water supply available to the SWP and CVP for exports south of the Delta. Total long-term average annual Delta exports under Alternative 6A would decrease as compared to exports under Existing Conditions and the No Action Alternative. The decrease would be greater compared to Existing Conditions because Existing Conditions does not include Fall X2 requirements, increased north of Delta demands, and sea level rise and climate change. However, the incremental change as compared to Existing Conditions would reflect changes in operations due to Alternative 6A and due to SWP and CVP operations with increased north of Delta demands, sea level rise and climate change that would occur without implementation of Alternative 6A.

Monthly Delta export patterns are presented in Figures 5-21 through 5-29. Results for changes in Delta exports are presented in more detail in Appendix 5A BDCP EIR/S Modeling.

Change in SWP and CVP Deliveries

Changes in SWP and CVP deliveries under Alternative 6A as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 6A, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

CEQA Conclusion**:** Constructing Alternative 6A water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

As described before, elimination of diversions at the south Delta intakes reduces operational flexibility and water supply available to the SWP and CVP for exports south of the Delta. The incremental changes in deliveries under Alternative 6A as compared to Existing Conditions would be caused by the facility and operations assumptions of Alternative 6A, (including north Delta intakes capacity of 15,000 cfs, no south Delta intakes diversions, and Fall X2), increased north of Delta demand and changes in sea level rise and climate change; whereas the net incremental changes in deliveries under Alternative 6A as compared to the No Action Alternative would be caused by the facility and operations assumptions of Alternative 6A alone.

Results for SWP and CVP deliveries are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Total CVP Deliveries

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 6A would decrease by 202 TAF (5%) and 189 TAF (10%),respectively compared to deliveries under No Action Alternative.

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries would decrease by 374 TAF (8%) and 469 TAF (21%), respectively compared to deliveries under Existing Conditions.

A comparison with exports under the No Action Alternative provides an indication of the potential changes due to Alternative 6A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total CVP south of Delta deliveries would decrease under Alternative 6A as compared to the deliveries under the No Action Alternative. Therefore, average annual total CVP south of Delta deliveries would decrease under Alternative 6A as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Average annual CVP north of Delta agricultural deliveries would be reduced by 19 TAF (12%) compared to the No Action Alternative. Under Alternative 6A, deliveries would be reduced in 90% of years and no deliveries would be made in about additional 10% of the years compared to the No Action Alternative, as shown in Figure 5-32

Average annual CVP north of Delta agricultural deliveries would be reduced by 92 TAF (39%) compared to Existing Conditions. Under Alternative 6A, deliveries would be reduced in 90% of years and no deliveries would be made in about 20% of the years compared to 1% of the years in the Existing Conditions, as shown in Figure 5-32; however, this decrease partially would occur due to sea level rise and climate change. Sea level rise and climate change require additional water to be released from CVP reservoirs to meet Delta water quality requirements.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 6A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta agricultural deliveries would decrease under Alternative 6A as compared to the deliveries under the No Action Alternative. Therefore, average annual north of Delta agricultural deliveries would decrease under Alternative 6A as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Average annual CVP south of Delta agricultural deliveries would be reduced by 155 TAF (21%) compared the No Action Alternative. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South of Delta Water Supplies*, and within applicable resource chapters. Under Alternative 6A, south of Delta CVP agricultural deliveries decrease in about 60% of years and no deliveries would be made in additional 20% of years compared to the No Action Alternative, as shown in Figure 5-31.

Average annual CVP south of Delta agricultural deliveries would be reduced by 395 TAF (41%) compared to Existing Conditions. Under Alternative 6A, south of Delta CVP agricultural deliveries decrease in about 90% of years and no deliveries would be made in about 30% of years compared to 1% of the years in the Existing Conditions, as shown in Figure 5-31; however, this decrease partially would occur due to sea level rise and climate change.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 6A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta agricultural deliveries would decrease under Alternative 6A as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta agricultural deliveries would decrease under Alternative 6A as compared to the conditions without the project.

CVP Settlement and Exchange Contract Deliveries

There would be an average annual increase of 17 TAF (1%) in CVP Settlement Contract deliveries and an average annual decrease of 8 TAF (1%) in CVP Exchange Contractors deliveries during dry and critical years under Alternative 6A compared to deliveries under the No Action Alternative. The decrease in Exchange Contractors deliveries would be attributable to reduced export capability and reduced storage in San Luis Reservoir because of the lack of south Delta diversions. Under this type of extreme export condition the Exchange Contractors would call on San Joaquin River water, but the CALSIM II model operating rules do not include this supply option.

There would be an average annual decrease of 35 TAF (2%) in CVP Settlement Contract deliveries and an average annual decrease of 9 TAF (1%) in CVP Exchange Contractors deliveries during dry and critical years under Alternative 6A compared to deliveries under Existing Conditions. These conditions would be attributable to more frequent reductions in storage to dead pool storages in upstream reservoirs, as described previously. However, the decrease in deliveries partially would occur due to sea level rise and climate change.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 6A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract deliveries during dry and critical years increase and CVP Exchange Contractors deliveries during dry and critical years decrease under Alternative 6A as compared to the deliveries under the No Action Alternative. Therefore, CVP Settlement Contract deliveries during dry and critical years would increase and Exchange Contractor deliveries during dry and critical years would decrease under Alternative 6A as compared to the conditions without the project. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

CVP North of Delta Municipal and Industrial Deliveries

Average annual CVP north of Delta M&I deliveries increase by 3 TAF (1%) as compared to deliveries under the No Action Alternative. Alternative 6A north of Delta M&I deliveries would be similar to deliveries under the No Action Alternative in all years, as shown in Figure 5-32.

Average annual CVP north of Delta M&I deliveries increase by 174 TAF (83%) as compared to deliveries under Existing Conditions. These changes primarily would occur because there would be an increase in north of Delta M&I water rights demands under both Alternative 6A and No Action Alternative as compared to demands under Existing Conditions. Alternative 6A north of Delta M&I deliveries would increase in all years compared to Existing Conditions, as shown in Figure 5-32.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 6A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries would increase under Alternative 6A as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries would increase under Alternative 6A as compared to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Average annual CVP south of Delta M&I deliveries would be reduced by about 15 TAF (14%) compared to the No Action Alternative. Alternative 6A south of Delta CVP M&I deliveries would decrease in about 60% of years, as shown in Figure 5-33. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South of Delta Water Supplies*, and within applicable resource chapters.

Average annual CVP south of Delta M&I deliveries would be reduced by about 27 TAF (23%) compared to Existing Conditions. Alternative 6A south of Delta CVP M&I deliveries would decrease in about 95% of years, as shown in Figure 5-33. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South of Delta Water Supplies*, and within applicable resource chapters.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 6A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta M&I deliveries would decrease under Alternative 6A as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta M&I deliveries would decrease under Alternative 6A as compared to the conditions without the project.

Total SWP Deliveries

Average annual total SWP deliveries under Alternative 6A would decrease by about 438 TAF (13%) compared to the No Action Alternative. Changes in frequency of annual total SWP deliveries is provided in Appendix 5A, *BDCP EIR/S Modeling Technical Appendix*.

Average annual total SWP south of Delta deliveries, including Table A (including Article 56) plus Article 21 deliveries, under Alternative 6A would decrease by about 436 TAF (19%) compared to the No Action Alternative. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South of Delta Water Supplies*, and within applicable resource chapters). Alternative 6A SWP south of Delta deliveries would increase in about 35% of years during wetter periods and decrease in almost 65% of years, as shown in Figure 5-34.

Average annual total SWP deliveries under Alternative 6A would decrease by about 832 TAF (22%) compared to Existing Conditions.

Average annual total SWP south of Delta deliveries, including Table A (including Article 56) plus Article 21 deliveries, under Alternative 6A would decrease by about 806 TAF (30%) compared to Existing Conditions. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South of Delta Water Supplies*, and within applicable resource chapters). The reduction in deliveries under Alternative 6A would be greater as compared to the No Action Alternative primarily because Existing Conditions does not include Fall X2 requirements, increased north of Delta demands and sea level rise and climate change. Alternative 6A SWP south of Delta deliveries would increase in about 35% of years during wetter periods and decrease in almost 65% of years, as shown in Figure 5-34.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 6A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total SWP south of Delta deliveries would decrease under Alternative 6A as compared to the deliveries under the No Action

Alternative. Therefore, average annual total SWP south of Delta deliveries would decrease under Alternative 6A as compared to the conditions without the project.

SWP Table A Deliveries

Average annual SWP Table A deliveries would decrease under Alternative 6A by about 478 TAF (20%) as compared to deliveries under the No Action Alternative. Average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) would decrease under Alternative 6A by about 468 TAF (20%) as compared to deliveries under the No Action Alternative. Alternative 6A SWP Table A deliveries increase in about 35% of years during wetter conditions and decrease in almost 65% of years, as shown in Figure 5-35.

Average annual SWP Table A deliveries would decrease under Alternative 6A by about 742 TAF (28%) as compared to Existing Conditions. Average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) would decrease under Alternative 6A by about 743 TAF (29%) as compared to Existing Conditions and. Alternative 6A SWP Table A deliveries increase in about 30% of years during wetter conditions and decrease in almost 70% of years, as shown in Figure 5-35.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 6A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP south of Delta Table A deliveries would decrease under Alternative 6A as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP south of Delta Table A deliveries would decrease under Alternative 6A as compared to the conditions without the project.

SWP Article 21 Deliveries

Average annual SWP Article 21 deliveries would increase by about 34 TAF (72%) as compared to deliveries under the No Action Alternative. The frequency of Alternative 6A Article 21 deliveries would increase about 10% and increased SWP Article 21 deliveries are observed in about 25% of the years compared to the No Action Alternative, as shown in Figure 5-36.

Average annual SWP Article 21 deliveries would decrease by about 77 TAF (49%) as compared to deliveries under Existing Conditions. The frequency of Alternative 6A Article 21 deliveries would decrease about 10% compared to Existing Conditions, as shown in Figure 5-36.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 6A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual Article 21 deliveries would increase under Alternative 6A as compared to the deliveries under the No Action Alternative. Therefore, average annual Article 21 deliveries would increase under Alternative 6A as compared to the conditions without the project.

SWP Feather River Service Area

There would be an average annual increase of 18 TAF (2%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 6A compared to deliveries under the No Action Alternative.

There would be an average annual decrease of 37 TAF (4%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 6A compared to deliveries under Existing Conditions. The primary cause of this reduction would be change in SWP operations due to sea level rise and climate change.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 6A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries would increase under Alternative 6A as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP Feather River Service Area deliveries would increase under Alternative 6A as compared to the conditions without the project.

NEPA Effects: Overall, SWP and CVP deliveries would decrease under Alternative 6A as compared to deliveries under No Action Alternative. This comparison provides an indication of the changes due to Alternative 6A without the effects of sea level rise and climate change. Therefore, average annual SWP and CVP deliveries would decrease under Alternative 6A as compared to the conditions without the project. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 6A would decline as compared to deliveries under Existing Conditions. As shown above in the NEPA analysis, SWP and CVP deliveries would decrease under Alternative 6A as compared to deliveries under conditions in 2060 without Alternative 6A if sea level rise and climate change conditions are considered the same under both scenarios. Therefore, deliveries would decrease under Alternative 6A as compared to Existing Conditions. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 6A decreases the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to existing conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would increase, as well as the volume of those transfers. The demand for water transfers to supplement supply shortages is estimated to increase from 52 percent of years to 77 percent of years compared to existing conditions, and the average annual cross-Delta transfers are estimated to increase from 146,000 acre-feet to about 378,000 acre-feet per year compared to existing conditions, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Alternative 6A decreases project water supply allocations as compared to the No Action Alternative, and consequently will increase cross-Delta water transfer demand compared to that alternative. The demand for water transfers to supplement supply shortages is estimated to increase from 68 percent of years to 77 percent of years compared to the No Action Alternative, and the average annual volume of cross-Delta transfers is estimated to increase from about 280,000 acre-feet per year to about 378,000 acre-feet per year compared to the No Action Alternative.

Alternative 6A provides a separate cross-Delta facility with additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including BDCP permit terms as discussed in Alternative 1A.

CEQA Conclusion: Alternative 6A would increase water transfer demand compared to existing conditions. Alternative 6A would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.12 Alternative 6B—Isolated Conveyance with East Alignment and Intakes 1–5 (15,000 cfs; Operational Scenario D)

Facilities construction under Alternative 6B would be similar to those described for Alternative 1B. Alternative 6B water conveyance operations would be the same as for Alternative 6A.

Summary of Water Supply Operations under Alternative 6B

Change in Delta Outflow

Please refer Alternative 6A because the operations would be identical to those under Alternative 6A.

Change in SWP and CVP Reservoir Storage

Please refer to Alternative 6A because the operations would be identical to those under Alternative 6A.

Change in Delta Exports

The changes in Delta exports resulting from operation of Alternative 6B would be the same as those described under Alternative 6A because operations would be identical.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 6B, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

***CEQA Conclusion*:** Constructing Alternative 6B water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

NEPA Effects: The changes in SWP and CVP deliveries resulting from operation of Alternative 6B would be the same as those described under Alternative 6A, Impact WS-2 because operations would be identical.

CEQA Conclusion: SWP and CVP deliveries under Alternative 6B would decline as compared to deliveries under Existing Conditions. As shown above in the NEPA analysis for Alternative 6A, SWP and CVP deliveries would decrease under Alternative 6B as compared to deliveries under conditions in 2060 without Alternative 6A if sea level rise and climate change conditions are considered the same under both scenarios. Therefore, deliveries would decrease under Alternative 6B as compared to Existing Conditions. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Effects from potential additional water transfers would be the same as those described under Alternative 6A. Transfers enabled by operations under Alternative 6B could result in increases in Delta exports and in SWP or CVP deliveries.

CEQA Conclusion: Alternative 6B could increase water transfer demand compared to existing conditions. Alternative 6B would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.13 Alternative 6C—Isolated Conveyance with West Alignment and Intakes W1–W5 (15,000 cfs; Operational Scenario D)

Facilities construction under Alternative 6C would be similar to those described for Alternative 1C. Alternative 6C water conveyance operations would be the same as for Alternative 6A.

Summary of Water Supply Operations under Alternative 6C

Change in Delta Outflow

Please refer to Alternative 6A because the operations would be identical to those under Alternative 6A.

Change in SWP and CVP Reservoir Storage

Please refer to Alternative 6A because the operations would be identical to those under Alternative 6A.

Change in Delta exports

The changes in Delta exports resulting from operation of Alternative 6C would be the same as those described under Alternative 6A, Impact WS-2 because operations would be identical.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 6C, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

***CEQA Conclusion*:** Constructing Alternative 6C water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

NEPA Effects: The changes in SWP and CVP deliveries resulting from operation of Alternative 6C would be the same as those described under Alternative 6A, Impact WS-2 because operations would be identical.

CEQA Conclusion: SWP and CVP deliveries under Alternative 6C would decline as compared to deliveries under Existing Conditions. As shown in the NEPA analysis for Alternative 6A, SWP and CVP deliveries would decrease under Alternative 6C as compared to deliveries under conditions in 2060 without Alternative 6A if sea level rise and climate change conditions are considered the same under both scenarios. Therefore, deliveries would decrease under Alternative 6C as compared to Existing Conditions. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Effects from potential additional water transfers would be the same as those described under Alternative 6A. Transfers enabled by operations under Alternative 6C could result in increases in Delta exports and in SWP or CVP deliveries.

CEQA Conclusion: Alternative 6C could increase water transfer demand compared to existing conditions. Alternative 6C would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.14 Alternative 7—Dual Conveyance with Pipeline/Tunnel, Intakes 2, 3, and 5, and Enhanced Aquatic Conservation (9,000 cfs; Operational Scenario E)

Facilities construction under Alternative 7 would be similar to those described for Alternative 1A with only three intakes. Alternative 7 water conveyance operations would follow the operational criteria described as Scenario E. These operations criteria are described in detail in Section 3.6.4.2 in Chapter 3, *Description of Alternatives*, and in Appendix 5A, *BDCP EIR/S Modeling.* A description of the changes in Delta outflow, reservoir storage, Delta exports, and SWP and CVP deliveries is provided below. The results for Alternative 7 include sea level rise and climate change that would occur at late long-term [LLT] around Year 2060. As described in Section 5.3.1 Methods of Analysis, sea level rise and climate change affect SWP and CVP operations and require additional water to be released from SWP and CVP reservoirs to meet Delta water quality requirements.

Summary of Water Supply Operations under Alternative 7

Change in Delta Outflow

Changes in average annual Delta outflow under Alternative 7 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Long-term average, wet, and dry year outflows increase in October through March under Alternative 7 compared to the No Action Alternative due to the to the decrease in SWP and CVP exports because of the reductions in south Delta exports, less negative Old and Middle River and Rio Vista flow requirements, and the increased period for the San Joaquin River Inflow/Export Ratio.

The incremental changes in Delta outflow between Alternative 7 and Existing Conditions would be a function of both the facility and operations assumptions of Alternative 7 (including north Delta intakes capacity of 9,000 cfs, Fall X2, San Joaquin River Inflow-Export ratio requirements, less negative Old and Middle River flow requirements, and reductions in diversions from south Delta) and the reduction in water supply availability due to increased north of Delta demands, sea level rise and climate change.

Results for changes in Delta Outflow are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 7 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-4 through 5-6 for Trinity Lake, Shasta lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in figures 5-13 through 5-16 for completeness. Results for changes in SWP and CVP reservoir storages are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Trinity Lake

Average annual end of September Trinity Lake storage would decrease by 3 TAF (<1%) compared to the No Action Alternative and exhibit a decrease in about 50% of the years, as shown in Figure 5-6.

Average annual end of September Trinity Lake storage would decrease by 234 TAF (17%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-6. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 7 and the results show that average annual end of September Trinity Lake storage would decrease under Alternative 7 as compared to the conditions without the project.

Shasta Lake

Average annual end of September Shasta Lake storage would decrease by 30 TAF (1%) compared to the No Action Alternative and exhibit a decrease in about 55% of the years, as shown in Figure 5-8.

Average annual end of September Shasta Lake storage would decrease by 511 TAF (19%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-8. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 7 and the results show that average annual end of September Shasta Lake storage would decrease under Alternative 7 as compared to the conditions without the project.

Lake Oroville

Average annual end of September Lake Oroville storage would increase by 234 TAF (17%) compared to the No Action Alternative and exhibit an increase in about 95% of the years, as shown in Figure 5-10.

Average annual end of September Lake Oroville storage would decrease by 412 TAF (20%) compared to Existing Conditions and exhibit a decrease in about 80% of the years, as shown in Figure 5-10. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 7 and the results show that average annual end of September Lake Oroville storage would increase under Alternative 7 as compared to the conditions without the project.

Folsom Lake

Average annual end of September Folsom Lake storage would decrease by 11 TAF (3%) compared to the No Action Alternative and exhibit a decrease in about 65% of the years, as shown in Figure 5-12.

Average annual end of September Folsom Lake storage would decrease by 157 TAF (30%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-12. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 7 and the results show that average annual end of September Folsom Lake storage would decrease under Alternative 7 as compared to the conditions without the project.

Change in Delta Exports

Changes in average annual Delta exports under Alternative 7 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-17 through 5-20 and Tables 5-4 through 5-6.

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 7 change SWP and CVP Delta exports as compared to Delta exports under Existing Conditions and the No Action Alternative. Total long-term average annual Delta exports under Alternative 7 would decrease as compared to exports under Existing Conditions and No Action Alternative. However, the incremental decrease as compared to Existing Conditions would reflect changes in operations due to Alternative 7 (including north Delta intakes capacity of 9,000 cfs, Fall

X2, San Joaquin River Inflow-Export ratio requirements, less negative Old and Middle River flow requirements, and reductions in diversions from south Delta) and due to SWP and CVP operations with increased north of Delta demands, sea level rise and climate change that would occur without implementation of Alternative 7.

Monthly Delta export patterns are presented in Figures 5-21 through 5-29. Results for changes in Delta exports are presented in more detail in Appendix 5A BDCP EIR/S Modeling.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 7, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

CEQA Conclusion**:** Constructing Alternative 7 water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The addition of the north Delta intakes provides operational flexibility to the SWP and CVP. The incremental changes in deliveries under Alternative 7 as compared to Existing Conditions would be caused by the facility and operations assumptions of Alternative 7, (including north Delta intakes capacity of 9,000 cfs, Fall X2, San Joaquin River Inflow-Export ratio requirements, less negative Old and Middle River flow requirements, and reductions in diversions from south Delta), increased north of Delta demands, and changes in sea level rise and climate change.

Results for SWP and CVP deliveries are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Total CVP Deliveries

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries would decrease by 221 TAF (5%) and 187 TAF (10%), respectively compared to deliveries No Action Alternative.

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries would decrease by 393 TAF (8%) and 467 TAF (21%), respectively compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 7 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total CVP deliveries and average annual total CVP south of Delta deliveries would decrease under Alternative 7 as compared to the deliveries under the No Action Alternative. Therefore, average annual total CVP deliveries and average annual total CVP south of Delta deliveries would decrease under Alternative 7 as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Average annual CVP north of Delta agricultural deliveries would be reduced by 25 TAF (15%) compared to the No Action Alternative. Under Alternative 7, deliveries would be reduced in all years and no deliveries would be made in about 20% of years compared to about 10% of years under the No Action Alternative, as shown in Figure 5-30.

Average annual CVP north of Delta agricultural deliveries would be reduced by 97 TAF (42%) compared to Existing Conditions. Under Alternative 7, deliveries would be reduced in all years and no deliveries would be made in about 20% of years compared to about 1% of years under the Existing Conditions, as shown in Figure 5-30; however, this decrease partially would occur due to sea level rise and climate change. Sea level rise and climate change require additional water to be released from CVP reservoirs to meet Delta water quality requirements.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 7 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta agricultural deliveries would decrease under Alternative 7 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta agricultural deliveries would decrease under Alternative 7 as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Average annual CVP south of Delta agricultural deliveries would be reduced by 150 TAF (21%) compared to the No Action Alternative (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South of Delta Water Supplies*, and within applicable resource chapters). Under Alternative 7, south of Delta CVP agricultural deliveries decrease in 70% of the years and no deliveries would be made in about 30% of years compared to about 10% of years under the No Action Alternative, as shown in Figure 5-31.

Average annual CVP south of Delta agricultural deliveries would be reduced by 390 TAF (40%) compared to Existing Conditions. Under Alternative 7, south of Delta CVP agricultural deliveries decrease in almost all years and no deliveries would be made in about 30% of the years compared to about 1% of years under the Existing Conditions, as shown in Figure 5-31; however, this decrease partially would occur due to sea level rise and climate change.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 7 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta agricultural deliveries would decrease under Alternative 7 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta agricultural deliveries would decrease under Alternative 7 as compared to the conditions without the project.

CVP Settlement and Exchange Contract Deliveries

There would be an average annual decrease of 12 TAF (1%) in CVP Settlement Contract deliveries and 10 TAF (1%) in CVP Exchange Contractor deliveries during dry and critical years under Alternative 7 as compared to deliveries the No Action Alternative. These conditions would be attributable to more frequent reductions in storage to dead pool storages in upstream reservoirs as described previously and reduction in exports. Under this type of extreme export condition the Exchange Contractors would call on San Joaquin River water, but the CALSIM II model operating rules do not include this supply option. There would be an average annual decrease of 64 TAF (4%) in CVP Settlement Contract deliveries and 10 TAF (1%) in CVP Exchange Contractor deliveries during dry and critical years under Alternative 7 as compared to deliveries under Existing Conditions. These conditions would be attributable to more frequent reductions in storage to dead pool storages in upstream reservoirs as described previously and reduction in exports, As described under Impact WS-2. However, the decrease in deliveries partially would occur due to sea level rise and climate change.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 7 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years would decrease by under Alternative 7 as compared to the deliveries under the No Action Alternative. Therefore, CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years would decrease under Alternative 7 as compared to the conditions without the project. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

CVP North of Delta Municipal and Industrial Deliveries

Average annual CVP north of Delta M&I deliveries under Alternative 7 would be similar to deliveries under the No Action Alternative, as shown in Figure 5-32.

Average annual CVP north of Delta M&I deliveries increase by 170 TAF (81%) as compared to deliveries under Existing Conditions. Alternative 7 north of Delta M&I deliveries would increase in all years compared to existing, as shown in Figure 5-32. These changes primarily would occur because there would be an increase in north of Delta M&I water rights demands under both Alternative 7 and No Action Alternative as compared to demands under Existing Conditions.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 7 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries under Alternative 7 would be similar (less than 1% change) to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries under Alternative 7 would be similar to the deliveries under the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Average annual CVP south of Delta M&I deliveries would be reduced by about 15 TAF (14%) compared the No Action Alternative. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South Delta Water Supplies*, and within applicable resource chapters). Alternative 7 south of Delta CVP M&I deliveries would decrease in about 70% of years, as shown in Figure 5-33.

Average annual CVP south of Delta M&I deliveries would be reduced by about 28 TAF (23%) compared to Existing Conditions. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South Delta Water Supplies*, and within applicable resource chapters. Alternative 7 south of Delta CVP M&I deliveries would decrease in about 90% of years, as shown in Figure 5-33.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 7 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta M&I deliveries would decrease under Alternative 7 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta M&I deliveries would decrease under Alternative 7 as compared to the conditions without the project.

Total SWP deliveries

Average annual total SWP deliveries under Alternative 7 would decrease by about 422 TAF (13%) compared to the No Action Alternative. Changes in frequency of annual total SWP deliveries is provided in Appendix 5A, BDCP EIR/S Modeling.

Average annual total SWP south of Delta deliveries, including Table A (including Article 56) plus Article 21 deliveries, under Alternative 7 would decrease by about 419 TAF (18%) compared to the No Action Alternative. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South of Delta Water Supplies*, and within applicable resource chapters. Alternative 7 SWP south of Delta deliveries would be less than deliveries under the No Action Alternative in about 60% of the years, as shown in Figure 5-34.

Average annual total SWP deliveries under Alternative 7 would decrease by about 816 TAF (22%) compared to Existing Conditions. Changes in frequency of annual total SWP deliveries is provided in Appendix 5A, BDCP EIR/S Modeling.

Average annual total SWP south of Delta deliveries, including Table A (including Article 56) plus Article 21 deliveries, under Alternative 7 would decrease by about 789 TAF (29%) compared to Existing Conditions. The reduction in deliveries under Alternative 7 compared to Existing Conditions would be greater than those compared to the No Action Alternative primarily because Existing Conditions does not include Fall X2 requirements, increased north of Delta demands, sea level rise and climate change. Alternative 7 SWP south of Delta deliveries would be similar to Existing Conditions in about 30% of years during wetter periods and decrease in almost 70% of years during drier periods, as shown in Figure 5-34.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 7 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total SWP south of Delta deliveries would decrease as compared to the deliveries under the No Action Alternative. Therefore, average annual total SWP south of Delta deliveries would decrease under Alternative 7 as compared to the conditions without the project.

SWP Table A Deliveries

Average annual SWP Table A deliveries would decrease under Alternative 7 by about 414 TAF (17%) as compared to deliveries under the No Action Alternative. Alternative 7 SWP Table A deliveries remain similar or increase in about 40% of years during wetter conditions and decrease in almost 60% of years during drier periods, as shown in Figure 5-35.

Average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) would decrease under Alternative 7 by about 406 TAF (18%) as compared to deliveries under the No Action Alternative.

Average annual SWP Table A deliveries would decrease under Alternative 7 by about 677 TAF (26%) as compared to Existing Conditions. Alternative 7 SWP Table A deliveries increase in about 30% of years during wetter conditions and decrease in almost 70% of years during drier periods, as shown in Figure 5-35.

Average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) would decrease under Alternative 7 by about 681 TAF (26%) as compared to Existing Conditions.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 7 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP south of Delta Table A deliveries would decrease under Alternative 7 as compared to the deliveries under the No Action Alternative. Therefore, average annual total SWP south of Delta Table A deliveries would decrease under Alternative 7 as compared to the conditions without the project.

SWP Article 21 Deliveries

Average annual SWP Article 21 deliveries would decrease by about 12 TAF (26%) as compared to deliveries under the No Action Alternative. The frequency of Alternative 7 Article 21 deliveries would be similar (about 18% of the years) to the deliveries under the No Action Alternative, although with reduced amount of Article 21 deliveries (reduction from an annual average of 47 TAF under the No Action Alternative to 35 TAF under Alternative 7), as shown in Figure 5-36.

Average annual SWP Article 21 deliveries would decrease by about 123 TAF (78%) as compared to deliveries under Existing Conditions. The frequency of Alternative 7 Article 21 deliveries would decrease an additional 25% compared to Existing Conditions, as shown in Figure 5-36.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 7 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual Article 21 deliveries would decrease under Alternative 7 as compared to the deliveries under the No Action Alternative. Therefore, average annual Article 21 deliveries would decrease under Alternative 7 as compared to the conditions without the project.

Feather River Service Area

There would be an average annual increase of 12 TAF (1%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 7 compared to deliveries under the No Action Alternative.

There would be an average annual decrease of 43 TAF (5%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 7 compared to deliveries under Existing Conditions. The primary cause of this reduction would be change in SWP operations due to sea level rise and climate change.

A comparison with exports under the No Action Alternative provides an indication of the potential change due to Alternative 7 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries would increase under Alternative 7 as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP Feather River Service Area deliveries would increase under Alternative 7 as compared to the conditions without the project.

NEPA Effects: Overall, SWP and CVP deliveries would decrease under Alternative 7 as compared to deliveries under No Action Alternative. This comparison provides an indication of the changes due to Alternative 7 without the effects of sea level rise and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 7 would decline as compared to deliveries under Existing Conditions. As shown above in the NEPA analysis, SWP and CVP deliveries would decrease under Alternative 7 as compared to deliveries under conditions in 2060 without Alternative 7 if sea level rise and climate change conditions are considered the same under both scenarios. Therefore, deliveries would decrease under Alternative 7 as compared to Existing Conditions. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 7 decreases the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to existing conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would increase, as well as the volume of those transfers. The demand for water transfers to supplement supply shortages is estimated to increase from 52 percent of years to 79 percent of years compared to existing conditions, and the average annual cross-Delta transfers are estimated to increase from 146,000 acre-feet to about 393,000 acre-feet per year compared to existing conditions, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Alternative 7 decreases project water supply allocations as compared to the No Action Alternative, and consequently will increase cross-Delta water transfer demand compared to that alternative. The demand for water transfers to supplement supply shortages is estimated to increase from 68 percent of years to 79 percent of years compared to the No Action Alternative, and the average annual volume of cross-Delta transfers is estimated to increase from about 280,000 acre-feet per year to about 393,000 acre-feet per year compared to the No Action Alternative.

Alternative 7 provides a separate cross-Delta facility with additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including BDCP permit terms as discussed in Alternative 1A.

CEQA Conclusion: Alternative 7 would increase water transfer demand compared to existing conditions. Alternative 7 would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.15 Alternative 8—Dual Conveyance with Pipeline/Tunnel, Intakes 2, 3, and 5, and Increased Delta Outflow (9,000 cfs; Operational Scenario F)

Facilities construction under Alternative 8 would be similar to those described for Alternative 1A with only three intakes. Alternative 8 water conveyance operations would follow the operational criteria described as Scenario F. These operations criteria are described in detail in Section 3.6.4.2 in Chapter 3, *Description of Alternatives* and in Appendix 5A, *BDCP EIR/S Modeling.*

A description of the changes in Delta outflow, reservoir storage, Delta exports, and SWP and CVP deliveries is provided below. The results for Alternative 8 would occur at Late Long-Term around Year 2060. As described in Section 5.3.1 Methods of Analysis, sea level rise and climate change affect SWP and CVP operations and require additional water to be released from SWP and CVP reservoirs to meet Delta water quality requirements.

Summary of Water Supply Operations under Alternative 8

Change in Delta Outflow

Changes in average annual Delta outflow under Alternative 8 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-4 through 5-6.

Long-term average, wet, and dry year outflows increase in October through June due to the minimum flow requirement at Freeport dedicated to the Delta outflow and decrease in SWP and CVP exports because of the reduced south Delta exports, less negative Old and Middle River and Rio Vista flow requirements, and the increased period for the San Joaquin River Inflow/Export Ratio.

The incremental changes in Delta outflow between Alternative 8 and Existing Conditions would be a function of both the facility and operations assumptions of Alternative 8 (including Fall X2, reductions in diversions from south Delta, and flow requirement at Freeport dedicated to the Delta outflow) and the reduction in water supply availability due to increased north of Delta demands and sea level rise and climate change.

Results for changes in Delta Outflow are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 8 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-4 through 5-6 for Trinity Lake, Shasta lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in Figures 5-13 through 5-16 for completeness. Results for changes in SWP and CVP reservoir storages are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Trinity Lake

Average annual end of September Trinity Lake storage would increase by 20 TAF (2%) compared to the No Action Alternative and exhibit a increase in about 50% of the years, as shown in Figure 5-6.

Average annual end of September Trinity Lake storage would decrease by 211 TAF (15%) compared to Existing Conditions and exhibit a decrease in almost all of the years, as shown in Figure 5-6. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 8 and the results show that average annual end of September Trinity Lake storage would increase under Alternative 8 as compared to the conditions without the project.

Shasta Lake

Average annual end of September Shasta Lake storage would increase by 43 TAF (2%) compared to the No Action Alternative and exhibit an increase in about 65% of the years, as shown in Figure 5-8.

Average annual end of September Shasta Lake storage would decrease by 438 TAF (16%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-8. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 8 and the results show that average annual end of September Shasta Lake storage would increase under Alternative 8 as compared to the conditions without the project.

Lake Oroville

Average annual end of September Lake Oroville storage would increase by 130 TAF (9%) compared to the No Action Alternative and exhibit an increase in about 95% of the years, as shown in Figure 5-10.

Average annual end of September Lake Oroville storage would decrease by 517 TAF (25%) compared to Existing Conditions and exhibit a decrease in almost all of the years, as shown in Figure 5-10. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 8 and the results show that average annual end of September Lake Oroville storage would increase under Alternative 8 as compared to the conditions without the project.

Folsom Lake

Average annual end of September Folsom Lake storage would decrease by 6 TAF (2%) compared to the No Action Alternative and exhibit a decrease in about 50% of the years, as shown in Figure 5-12.

Average annual end of September Folsom Lake storage would decrease by 152 TAF (29%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-12. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 8 and the results show that average annual end of September Folsom Lake storage would decrease under Alternative 8 as compared to the conditions without the project.

Change in Delta Exports

Changes in average annual Delta exports under Alternative 8 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-17 through 5-20 and Tables 5-4 through 5-6.

The addition of the north Delta intakes under Alternative 8 provides operational flexibility to the SWP and CVP Delta operations. Total long-term average annual Delta exports under Alternative 8 would decrease as compared to exports under Existing Conditions and No Action Alternative because of the increased Delta outflow requirements. However, the incremental change as compared to Existing Conditions would reflect changes in operations due to Alternative 8 (including Fall X2, reductions in diversions from south Delta, and flow requirement at Freeport dedicated to the Delta outflow) and due to SWP and CVP operations with increased north of Delta demands, sea level rise and climate change that would occur without implementation of Alternative 8.

Monthly Delta export patterns are presented in Figures 5-21 through 5-29. Results for changes in Delta exports are presented in more detail in Appendix 5A BDCP EIR/S Modeling.

Change in SWP and CVP Deliveries

Changes in SWP and CVP deliveries under Alternative 8 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-3 through 5-5.

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 8, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

***CEQA Conclusion*:** Constructing Alternative 8 water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The addition of the north Delta intakes provides operational flexibility to the SWP and CVP Delta operations. However, these incremental changes reflect changes in operations due to Alternative 8 and due to SWP and CVP operations with increased north of Delta demand, sea level rise and climate change that would occur without implementation of Alternative 8. Therefore, the net incremental changes in deliveries under Alternative 8 as compared to Existing Conditions would be caused by the facility and operations assumptions of Alternative 8, (such as north Delta intakes capacity of 9,000 cfs, Fall X2, San Joaquin River Inflow-Export ratio requirements, Old and Middle River flow requirements, and minimum flow requirement at Freeport), increased north of Delta demand and changes in sea level rise and climate change.

Results for SWP and CVP deliveries are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Total CVP Deliveries

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 8 would decrease by 383 TAF (9%) and by 323 TAF (17%)respectively as compared to deliveries under No Action Alternative.

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 8 would decrease by 556 TAF (12%) and 602 TAF (27%), respectively compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 8 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total CVP south of Delta deliveries would decrease under Alternative 8 as compared to the deliveries under the No Action Alternative. Therefore, average annual total CVP south of Delta deliveries would decrease under Alternative 8 as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Average annual CVP north of Delta agricultural deliveries would be reduced by 29 TAF (18%) compared to the No Action Alternative. Alternative 8 deliveries would be reduced in almost all years (except for the wettest 3 % of the years); and no deliveries would be made in about an additional 10% of the years, as shown in Figure 5-30 under Alternative 8 as compared to No Action Alternative.

Average annual CVP north of Delta agricultural deliveries would be reduced by 102 TAF (44%) compared to Existing Conditions. Alternative 8 deliveries would be reduced in almost all years (except for the wettest 3 % of the years); and no deliveries would be made in about 23% of the years, as shown in Figure 5-30 under Alternative 8 as compared to Existing Conditions. This decrease partially would occur due to sea level rise and climate change. Sea level rise and climate change require additional water to be released from CVP reservoirs to meet Delta water quality requirements.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 8 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta agricultural deliveries would decrease under Alternative 8 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta agricultural deliveries would decrease under Alternative 8 as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Average annual CVP south of Delta agricultural deliveries would be reduced by 241 TAF (33%) compared to the No Action Alternative. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, Response to Reduced South of Delta Water Supplies and within applicable resource chapters. Alternative 8 south of Delta CVP agricultural deliveries decrease in almost all years; and no deliveries would be made in about an additional 20% of the years, as shown in Figure 5-31 under Alternative 8 as compared to No Action Alternative.

Average annual CVP south of Delta agricultural deliveries would be reduced by 481 TAF (50%) compared to Existing Conditions. Alternative 8 south of Delta CVP agricultural deliveries decrease in almost all years; and no deliveries would be made in about 30% of the years, as shown in Figure 5-31 under Alternative 8 as compared to Existing Conditions, however, this decrease partially would occur due to sea level rise and climate change.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 8 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta agricultural deliveries would decrease under Alternative 8 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta agricultural deliveries would decrease under Alternative 8 as compared to the conditions without the project.

CVP Settlement and Exchange Contract Deliveries

There would be an average annual decrease of 40 TAF (2%) in CVP Settlement Contract deliveries during dry and critical years under Alternative 8 as compared to deliveries under the No Action Alternative. These conditions would be attributable to more frequent reductions in storage to dead pool storages in upstream reservoirs.

CVP Exchange Contractor deliveries during dry and critical years would decrease 9 TAF (1%) compared to the No Action Alternative. These conditions would be attributable to more frequent reductions in storage to dead pool storages in upstream reservoirs as described previously and reduction in exports. Under this type of extreme export condition the Exchange Contractors would call on San Joaquin River water, but the CALSIM II model operating rules do not include this supply option.

There would be an average annual decrease of 92 TAF (5%) in CVP Settlement Contract deliveries during dry and critical years under Alternative 8 as compared to deliveries under Existing Conditions. These conditions would be attributable to more frequent reductions in storage to dead pool storages in upstream reservoirs. However, the decrease in deliveries partially would occur due to sea level rise and climate change.

CVP Exchange Contractor deliveries during dry and critical years would decrease 9 TAF (1%) compared to Existing Conditions. These conditions would be attributable to more frequent reductions in storage to dead pool storages in upstream reservoirs as described previously and reduction in exports. However, the decrease in deliveries partially would occur due to sea level rise and climate change.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 8 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years could decrease under Alternative 8 as compared to the deliveries under the No Action Alternative. Therefore, annual CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years would decrease under Alternative 8 as compared to the conditions without the project. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

CVP North of Delta Municipal and Industrial Deliveries

Average annual CVP north of Delta municipal and industrial deliveries decrease by 9 TAF (2%) as compared to deliveries under the No Action Alternative. Alternative 8 north of Delta municipal and industrial deliveries would be similar compared to the No Action Alternative in all years, as shown in Figure 5-32.

Average annual CVP north of Delta municipal and industrial deliveries increase by 163 TAF (77%) as compared to deliveries under Existing Conditions. Alternative 8 north of Delta municipal and industrial deliveries would increase in all years compared to Existing Conditions, as shown in Figure

5-32. This change primarily would occur because there would be an increase in north of Delta municipal and industrial water rights demands under both Alternative 8 and No Action Alternative as compared to demands under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 8 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries would decrease under Alternative 8 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries would decrease under Alternative 8 as compared to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Average annual CVP south of Delta municipal and industrial deliveries would be reduced by about 44 TAF (42%) compared to the No Action Alternative. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B. Response to Reduced South of Delta Water Supplies and within applicable resource chapters). Alternative 8 south of Delta CVP municipal and industrial deliveries would decrease in almost all years, as shown in Figure 5-33.

Average annual CVP south of Delta municipal and industrial deliveries would be reduced by about 57 TAF (49%) compared to Existing Conditions. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B. Response to Reduced South of Delta Water Supplies and within applicable resource chapters). Alternative 8 south of Delta CVP municipal and industrial deliveries would decrease in almost all years, as shown in Figure 5-33.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 8 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta M&I deliveries would decrease under Alternative 8 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta M&I deliveries would decrease under Alternative 8 as compared to the conditions without the project.

Total SWP deliveries

Average annual total SWP deliveries under Alternative 8 would decrease by about 990 TAF (30%) compared to existing the No Action Alternative. Changes in frequency of annual total SWP deliveries is provided in Appendix 5A, BDCP EIR/S Modeling.

Average annual total SWP south of Delta deliveries, including Table A (including Article 56) plus Article 21 deliveries, under Alternative 8 would decrease by about 907 TAF (39%) compared to the No Action Alternative. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B *Response to Reduced South of Delta Water Supplies* and within applicable resource chapters). Alternative 8 SWP deliveries would decrease in all years, as shown in Figure 5-34.

Average annual total SWP deliveries under Alternative 8 would decrease by about 1,384 TAF (37%) compared to Existing Conditions. Changes in frequency of annual total SWP deliveries is provided in Appendix 5A, BDCP EIR/S Modeling.

Average annual total SWP south of Delta deliveries, including Table A (including Article 56) plus Article 21 deliveries, under Alternative 8 would decrease by about 1,277 TAF (47%) compared to Existing Conditions. (Details regarding likely consequences of reduced deliveries can be reviewed in

Appendix 5B *Response to Reduced South of Delta Water Supplies* and within applicable resource chapters. The reduction in deliveries under Alternative 8 would be greater compared to the No Action Alternative primarily because Existing Conditions does not include Fall X2 and other outflow requirements and export restrictions. Alternative 8 SWP deliveries would decrease in all years, as shown in Figure 5-34.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 8 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total SWP south of Delta deliveries would decrease under Alternative 8 as compared to the deliveries under the No Action Alternative. Therefore, average annual total SWP south of Delta deliveries would decrease under Alternative 8 as compared to the conditions without the project.

SWP Table A Deliveries

Average annual SWP Table A deliveries with Article 56 (without Article 21) would decrease under Alternative 8 by about 935 TAF (40%) as compared to deliveries under the No Action Alternative. Average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) would decrease under Alternative 8 by about 910 TAF (40%) as compared to deliveries under the No Action Alternative. Alternative 8 SWP Table A deliveries decrease in all years, as shown in Figure 5-35.

Average annual SWP Table A deliveries with Article 56 (without Article 21) would decrease under Alternative 8 by about 1,199 TAF (46%) as compared to Existing Conditions. Average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) would decrease under Alternative 8 by about 1,185 TAF (46%) as compared to Existing Conditions. Alternative 8 SWP Table A deliveries decrease in all but few years, as shown in Figure 5-35.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 8 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP south of Delta Table A deliveries would decrease under Alternative 8 as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP south of Delta Table A deliveries would decrease under Alternative 8 as compared to the conditions without the project.

SWP Article 21 Deliveries

Average annual SWP Article 21 deliveries under Alternative 8 would be similar to as compared to deliveries under the No Action Alternative. The frequency of Alternative 8 Article 21 deliveries would be similar to the No Action Alternative although with varying annual Article 21 deliveries when those deliveries are made (with similar long-term annual average of 48 TAF), as shown in Figure 5-36.

Average annual SWP Article 21 deliveries would decrease by about 111 TAF (70%) as compared to deliveries under Existing Conditions. The frequency of Alternative 8 Article 21 deliveries would decrease about to 20% of years compared to Existing Conditions (40% of years), as shown in Figure 5-36.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 8 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual Article 21 deliveries under

Alternative 8 would be similar (less than 1% change) to deliveries under the No Action Alternative. Therefore, average annual Article 21 deliveries under Alternative 8 would be similar to the deliveries under the conditions without the project.

Feather River Service Area

There would be an average annual decrease of 116 TAF (14%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 8 compared to deliveries under the No Action Alternative.

There would be an average annual decrease of 171 TAF (19%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 8 compared to deliveries under Existing Conditions. The primary causes of this reduction would be changes in SWP operations due to sea level rise and climate change and Alternative 8 operations.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 8 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries would decrease under Alternative 8 as compared to the deliveries under the No Action Alternative. Therefore, average annual SWP Feather River Service Area deliveries would decrease under Alternative 8 as compared to the conditions without the project.

NEPA Effects: Overall, SWP and CVP deliveries would decrease under Alternative 8 as compared to deliveries under No Action Alternative. This comparison provides an indication of the changes due to Alternative 8 without the effects of sea level rise and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 8 would decline as compared to deliveries under Existing Conditions. As shown above in the NEPA analysis, SWP and CVP deliveries would decrease under Alternative 8 as compared to deliveries under conditions in 2060 without Alternative 8 if sea level rise and climate change conditions are considered the same under both scenarios. Therefore deliveries would decrease under Alternative 8 as compared to Existing Conditions. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 8 decreases the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to existing conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would increase, as well as the volume of those transfers. The demand for water transfers to supplement supply shortages is estimated to increase from 52 percent of years to 88 percent of years compared to existing conditions, and the average annual cross-Delta transfers are estimated to increase from 146,000 acre-feet to about 459,000 acre-feet per year compared to existing conditions, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Alternative 8 decreases project water supply allocations as compared to the No Action Alternative, and consequently will increase cross-Delta water transfer demand compared to that alternative. The demand for water transfers to supplement supply shortages is estimated to increase from 68 percent of years to 88 percent of years compared to the No Action Alternative, and the average annual volume of cross-Delta transfers is estimated to increase from about 280,000 acre-feet per year to about 459,000 acre-feet per year compared to the No Action Alternative.

Alternative 8 provides a separate cross-Delta facility with additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including BDCP permit terms as discussed in Alternative 1A.

CEQA Conclusion: Alternative 8 would increase water transfer demand compared to existing conditions. Alternative 8 would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.3.16 Alternative 9—Through Delta/Separate Corridors (15,000 cfs; Operational Scenario G)

Facilities constructed under Alternative 9 would include two fish-screened intakes along the Sacramento River near Walnut Grove, fourteen operable barriers, two pumping plants and other associated facilities, two culvert siphons, three canal segments, new levees, and new channel connections. Some existing channels would also be enlarged under this alternative. Alternative 9 water conveyance operations would follow the operational criteria described as Scenario G. These operations criteria are described in detail in Section 3.6.4.2 in Chapter 3, *Description of Alternatives*, and in Appendix 5A, *BDCP EIR/S Modeling.* A description of the changes in Delta outflow, reservoir storage, Delta exports, and SWP and CVP deliveries is provided below. The results for Alternative 9 include sea level rise and climate change that would occur at late long-term [LLT] around Year 2060. As described in Section 5.3.1 Methods of Analysis, sea level rise and climate change affect SWP and CVP operations and require additional water to be released from SWP and CVP reservoirs to meet Delta water quality requirements.

Model simulation results for Alternative 9 are summarized in Tables 5-3 through 5-6.

Summary of Water Supply Operations under Alternative 9

Change in Delta Outflow

Changes in average annual Delta outflow under Alternative 9 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-3 through 5-5.

Long-term average, wet, and dry year outflows would be similar to No Action Alternative, as shown in Figures 5-3 through 5-5.

The incremental changes in Delta outflow between Alternative 9 and Existing Conditions would be a function of both the facility and operations assumptions of Alternative 9 and the reduction in water supply availability due to increased north of Delta demand, sea level rise and climate change.

Results for changes in Delta Outflow are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 9 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-3 through 5-5 for Trinity Lake, Shasta lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in Figures 5-13 through 5-16 for completeness. Results for changes in SWP and CVP reservoir storages are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Trinity Lake

Average annual end of September Trinity Lake storage would increase by 2 TAF (<1%) compared to the No Action Alternative and exhibit a increase in about 50% of the years, as shown in Figure 5-6.

Average annual end of September Trinity Lake storage would decrease by 228 TAF (16%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-6. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 9 and the results show that average annual end of September Trinity Lake storage would increase under Alternative 9 as compared to the conditions without the project.

Shasta Lake

Average annual end of September Shasta Lake storage would decrease by 7 TAF (<1%) compared to the No Action Alternative and exhibit a decrease in about 40% of the years, as shown in Figure 5-8.

Average annual end of September Shasta Lake storage would decrease by 488 TAF (18%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-8. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 9 and the results show that average annual end of September Shasta Lake storage would decrease under Alternative 9 as compared to the conditions without the project.

Lake Oroville

Average annual end of September Lake Oroville storage would decrease by 3 TAF (<1%) compared to the No Action Alternative and exhibit a decrease in about 40% of the years, as shown in Figure 5-10.

Average annual end of September Lake Oroville storage would decrease by 649 TAF (32%) compared to Existing Conditions and exhibit a decrease in almost all of the years, as shown in Figure

5-10. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 9 and the results show that average annual end of September Lake Oroville storage would decrease under Alternative 9 as compared to the conditions without the project.

Folsom Lake

Average annual end of September Folsom Lake storage would increase by 10 TAF (3%) compared to the No Action Alternative and exhibit a increase in about 70% of the years, as shown in Figure 5-12.

Average annual end of September Folsom Lake storage would decrease by 135 TAF (26%) compared to Existing Conditions and exhibit a decrease in about 95% of the years, as shown in Figure 5-12. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 9 and the results show that average annual end of September Folsom Lake storage would increase under Alternative 9 as compared to the conditions without the project.

Change in Delta Exports

Changes in average annual Delta exports under Alternative 9 as compared to the No Action Alternative and Existing Conditions are shown in Figures 5-17 through 5-20 and Tables 5-3 through 5-5.

The facilities constructed under Alternative 9 and Delta regulatory requirements under Alternative 9 change SWP and CVP Delta exports as compared to Delta exports under Existing Conditions and the No Action Alternative. Total long-term average annual Delta exports under Alternative 9 would decrease as compared to exports under Existing Conditions and No Action Alternative. However, the incremental decrease as compared to Existing Conditions would reflect changes in operations due to Alternative 9 and due to SWP and CVP operations with increased north of Delta demand, sea level rise and climate change that would occur without implementation of Alternative 9.

Monthly Delta export patterns are presented in Figures 5-21 through 5-29. Results for changes in Delta exports are presented in more detail in Appendix 5A BDCP EIR/S Modeling.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP/CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 9, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

***CEQA Conclusion*:** Constructing Alternative 9 water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The incremental changes in SWP and CVP deliveries under Alternative 9 as compared to Existing Conditions would be caused by the facility and operations assumptions of Alternative 9, increased north of Delta demand and changes in sea level rise and climate change; whereas the incremental changes in deliveries under Alternative 9 as compared to the No Action Alternative would be caused by the facility and operations assumptions of Alternative 9 alone.

Results for SWP and CVP deliveries are presented in more detail in Appendix 5A *BDCP EIR/S Modeling*.

Total CVP Deliveries

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 9 would decrease by 44 TAF (1%) and by 20 TAF (1%), respectively compared to deliveries under No Action Alternative.

Average annual total CVP deliveries and average annual total south of the Delta CVP deliveries under Alternative 9 would decrease by 216 TAF (5%) and by 300 TAF (13%), respectively compared to deliveries under Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 9 without the effects of sea level rise and climate change. The results show that average annual total CVP south of Delta deliveries would decrease (by about 1%) under Alternative 9 as compared to the deliveries under the No Action Alternative. Therefore, average annual total CVP south of Delta deliveries would decrease under Alternative 9 as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Average annual CVP north of Delta agricultural deliveries would be reduced by 20 TAF (12%) compared to the No Action Alternative. Under Alternative 9, deliveries would be reduced in about 95% of years and there would be no CVP north of Delta agricultural deliveries in an additional 10% of the time compared to the No Action Alternative, as shown in Figure 5-30.

Average annual CVP north of Delta agricultural deliveries would be reduced by 92 TAF (40%) compared to Existing Conditions. Under Alternative 9, deliveries would be reduced in about 95% of years and there would be no CVP north of Delta agricultural deliveries in an additional 20% of the time compared to the Existing Conditions, as shown in Figure 5-30.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 9 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta agricultural deliveries would decrease under Alternative 9 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta agricultural deliveries would decrease under Alternative 9 as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Average annual CVP south of Delta agricultural deliveries would be reduced by 22 TAF (3%) compared to the No Action Alternative. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South Delta Water Supplies*, and within applicable resource chapters. Under Alternative 9, south of Delta CVP agricultural deliveries would decrease in about 40% of years compared to the No Action Alternative, as shown in Figure 5-31.

Average annual CVP south of Delta agricultural deliveries would be reduced by 262 TAF (27%) compared to Existing Conditions. Under Alternative 9, south of Delta CVP agricultural deliveries would decrease in about 95% of years compared to Existing Conditions, as shown in Figure 5-31; however, this decrease primarily would occur due to increased north of delta demands, sea level rise and climate change.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 9 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta agricultural deliveries would decrease under Alternative 9 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta agricultural deliveries would decrease under Alternative 9 as compared to the conditions without the project.

CVP Settlement and Exchange Contract Deliveries

There would be no changes to CVP Settlement Contract deliveries and deliveries to CVP Exchange Contractors under Alternative 9 compared to No Action Alternative.

There would be an average annual decrease of 54 TAF (3%) in CVP Settlement Contract deliveries during dry and critical years under Alternative 9 as compared to deliveries under Existing Conditions, because Shasta Lake storage would decline to dead pool more frequently as described previously. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

There would be no changes in deliveries to CVP Exchange Contractors under Alternative 9 compared to the Existing Conditions.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 9 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years would be similar (or less than 1% change) under Alternative 9 as compared to the deliveries under the No Action Alternative. Therefore, CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years under Alternative 9 would be similar to the deliveries under conditions without the project.

CVP North of Delta Municipal and Industrial Deliveries

Average annual CVP north of Delta M&I deliveries under Alternative 9 would decrease by 5 TAF (1%) as compared to deliveries under the No Action Alternative. Alternative 9 north of Delta M&I deliveries would be similar to deliveries under No Action Alternative, as shown in Figure 5-32.

Average annual CVP north of Delta M&I deliveries under Alternative 9 would increase by 166 TAF (79%) as compared to deliveries under Existing Conditions. These changes primarily would occur because there would be an increase in north of Delta M&I water rights demands under both Alternative 9 and No Action Alternative as compared to demands under Existing Conditions. Alternative 9 north of Delta M&I deliveries would increase in all years compared to Existing Conditions, as shown in Figure 5-32.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 9 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries would decrease under Alternative 9 as compared to the deliveries under the No Action. Therefore, average annual CVP north of Delta M&I deliveries would decrease under Alternative 9 as compared to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Average annual CVP south of Delta M&I deliveries would increase by 1 TAF (1 %) compared to the No Action Alternative. Alternative 9 south of Delta CVP M&I deliveries would decrease in about 30% of years, would increase in about 30% of the years and would be similar in remaining years, as shown in Figure 5-33.(Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South of Delta Water Supplies*, and within applicable resource chapters).

Average annual CVP south of Delta M&I deliveries would decrease by 12 TAF (10%) compared to Existing Conditions. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South of Delta Water Supplies*, and within applicable resource chapters. Alternative 9 south of Delta CVP M&I deliveries would decrease in about 90% of years except during the wetter conditions, as shown in Figure 5-33.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 9 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta M&I deliveries would increase slightly (1%) under Alternative 9 as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta M&I deliveries would be similar under Alternative 9 as compared to the conditions without the project.

Total SWP Deliveries

Average annual total SWP deliveries under Alternative 9 would decrease by about 30 TAF (1%) compared to deliveries under the No Action Alternative. Changes in frequency of annual total SWP deliveries is provided in Appendix 5A, BDCP EIR/S Modeling.

Average annual total SWP south of Delta deliveries, including Table A (including Article 56) plus Article 21 deliveries, under Alternative 9 would decrease by about 35 TAF (1%) compared to deliveries under the No Action Alternative. (Details regarding likely consequences of reduced deliveries can be reviewed in Appendix 5B, *Response to Reduced South of Delta Water Supplies*, and within applicable resource chapters. Alternative 9 SWP south of Delta deliveries would decrease in about 50% of years and would increase in about 50% of years during wetter periods, as shown in Figure 5-34.

Average annual total SWP deliveries under Alternative 9 would decrease by about 424 TAF (11%) compared to deliveries under existing. Changes in frequency of annual total SWP deliveries is provided in Appendix 5A, BDCP EIR/S Modeling.

Average annual total SWP south of Delta deliveries, including Table A (including Article 56) plus Article 21 deliveries, under Alternative 9 would decrease by about 405 TAF (15%) compared to deliveries under Existing Conditions. The decrease in deliveries would be greater as compared to the No Action Alternative primarily because Existing Conditions does not include sea level rise and climate change, increased north of Delta demands, and Fall X2 requirements. Alternative 9 SWP south of Delta deliveries would decrease in about 70% of years during drier periods compared to Existing Conditions and would increase in about 30% of years during wetter periods, as shown in Figure 5-34.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 9 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual total SWP south of Delta deliveries would decrease under Alternative 9 as compared to the deliveries under the No Action. Therefore, average annual total SWP south of Delta deliveries would decrease under Alternative 9 as compared to the conditions without the project.

SWP Table A Deliveries

Average annual SWP Table A deliveries with Article 56 (without Article 21)and average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) would decrease by about 17 TAF (1%) and 20 TAF (11%), respectively under Alternative 9 as compared to deliveries under the No Action Alternative. Alternative 9 SWP south of Delta Table A deliveries increase in about 50% of years during wetter conditions and decrease in about 50% of years during drier periods, as shown in Figure 5-35.

Average annual SWP Table A deliveries with Article 56 (without Article 21) and average annual SWP south of Delta Table A deliveries with Article 56 (without Article 21) would decrease by about 280 TAF (11%)and 295 TAF (11%) under Alternative 9 as compared to deliveries under Existing Conditions. Alternative 9 SWP south of Delta Table A deliveries increase in about 30% of years during wetter conditions and decrease in almost 70% of years during drier periods, as shown in Figure 5-35.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 9 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP south of Delta Table A deliveries would decrease. Therefore, average annual SWP south of Delta Table A deliveries would decrease under Alternative 9 as compared to the conditions without the project.

SWP Article 21 Deliveries

Average annual SWP Article 21 deliveries would decrease by about 14 TAF (30%) as compared to the No Action Alternative. The frequency of Alternative 9 Article 21 deliveries would be similar to the frequency under No Action Alternative, as shown in Figure 5-36.

Average annual SWP Article 21 deliveries would decrease by about 125 TAF (79%) as compared to deliveries under Existing Conditions. The frequency of Alternative 9 Article 21 deliveries would decrease about 30% compared to the frequency under Existing Conditions, as shown in Figure 5-36.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 9 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual Article 21 deliveries would decrease under Alternative 9 as compared to the deliveries under the No Action. Therefore, average annual Article 21 deliveries would decrease under Alternative 9 as compared to the conditions without the project.

Feather River Service Area

Average annual SWP Feather River Service Area deliveries under Alternative 9 would be similar to the deliveries under the No Action Alternative.

There would be an average annual decrease of 52 TAF (6%) in SWP Feather River Service Area deliveries during dry and critical years under Alternative 9 as compared to deliveries under Existing Conditions. The primary cause of this reduction would be change in SWP operations due to sea level rise and climate change.

A comparison with deliveries under the No Action Alternative provides an indication of the potential change due to Alternative 9 in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries under Alternative 9 would be similar to the deliveries under the No Action Alternative. Therefore, average annual SWP Feather River Service Area deliveries under Alternative 9 would be similar to the deliveries under the conditions without the project.

NEPA Effects: Overall, SWP and CVP deliveries would decrease 1% under Alternative 9 as compared to deliveries under No Action Alternative. This comparison provides an indication of the changes due to Alternative 9 without the effects of sea level rise and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 9 would decline as compared to deliveries under Existing Conditions. As shown above in the NEPA analysis, SWP and CVP deliveries would decrease 1% under Alternative 9 as compared to deliveries under conditions in 2060 without Alternative 9 if sea level rise and climate change conditions are considered the same under both scenarios. SWP and CVP deliveries under Alternative 9 would decrease as compared to deliveries under Existing Conditions, but the majority of the change is due to the effects of increased north of Delta water demands, sea level rise, and climate change. Indirect effects of changes in water deliveries are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 9 decreases the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to existing conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would increase, as well as the volume of those transfers. The demand for water transfers to supplement supply shortages is estimated to increase from 52 percent of years to 67 percent of years compared to existing conditions, and the average annual cross-Delta transfers are estimated to increase from 146,000 acre-feet to about 304,000 acre-feet per year compared to existing conditions, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Alternative 9 decreases project water supply allocations slightly as compared to the No Action Alternative, and consequently will increase cross-Delta water transfer demand compared to that alternative. The demand for water transfers to supplement supply shortages is estimated to decrease slightly from 68 percent of years to 67 percent of years compared to the No Action Alternative, and the average annual volume of cross-Delta transfers is estimated to increase from about 280,000 acre-feet per year to about 304,000 acre-feet per year compared to the No Action Alternative.

Alternative 9 provides a new through-Delta channel system that may have additional capacity to move transfer water from areas upstream of the Delta to export service areas and may provide a longer transfer window than allowed under current regulatory constraints. As a result, transfer water might be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including BDCP permit terms as discussed in Alternative 1A. Water level and in-Delta flow issues may continue to constrain transfer operations to a greater degree than for other alternatives.

CEQA Conclusion: Alternative 9 would increase water transfer demand compared to existing conditions. Alternative 9 would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Chapter 30, *Growth Inducement*, and other chapters addressing specific resources.

5.3.4 Cumulative Analysis

This cumulative impact analysis considers projects that could affect water supply and, where relevant, in the same time frame as an action alternative, result in a cumulative impact. Water supply resources effects in the Delta region and in the areas Upstream of the Delta and in Export Service Area would be expected to change as a result of past, present, and reasonably foreseeable future projects, related to changes in operations of new facilities. When the effects of the changes in water supply resources under the alternatives are considered in connection with the potential effects of projects listed in Chapter 3, *Description of Alternatives*, there could potentially be cumulative effects on water supply resources.

All of the BDCP alternatives included the assumption that the following programs identified to occur under the No Project Alternative and No Action Alternative were implemented.

- Grasslands Bypass Project.
- Lower American River Flow Management Standard (simulated in Existing Conditions, No Action Alternative, and all Alternatives).
- Delta-Mendota Canal / California Aqueduct Intertie.
- Freeport Regional Water Project.

Accordingly, the effects of those projects were included in the water supply operations presented in previous subsections of this chapter through the comparison of the BDCP alternatives and the No Action Alternative.

The Cumulative Analysis for water supply includes a comparison of conditions that could occur with and without the BDCP alternatives with conditions that could occur with implementation of the BDCP alternatives to determine if the combined effect of implementation of all of these projects could be cumulatively significant, and if so, could the incremental effect of the BDCP alternatives be considered cumulatively considerable.

5.3.4.1 Cumulative Analysis of Projects Not Assumed to be Operational in BDCP Alternatives

The following list presented in Table 5-10 includes projects considered for this cumulative effects section; for a complete list of such projects, consult Appendix 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions*.

Table 5-10. Effects on Water Supply from the Programs, Projects, and Policies considered for Cumulative Analysis

Agency	Program/ Project	Status	Description of Program/Project	Effects on Water Supply
Contra Costa Water District and Bureau of Reclamation	Los Vaqueros Reservoir Expansion Project	Program under development. Draft EIS/EIR in 2009. Final EIS/EIR in 2010. Estimated completion in 2012.	Project will increase the storage capacity of Los Vaqueros Reservoir and divert additional water from the Delta intake near Rock Slough to fill the additional storage volume (Bureau of Reclamation and Contra Costa Water District 2009).	The Los Vaqueros Expansion Project would provide water to South Bay water agencies that otherwise would receive all of their Delta supplies through the existing SWP and CVP export pumps. The purpose of the project would be to improve water quality to Bay Area water users and to adjust the pattern of diversions from the Delta to reduce impacts on aquatic resources. The project would be implemented to provide water supplies for previously identified water demands and not for additional non-identified growth. There would be no new demands or increased water rights or contract amounts. An environmental impact report has been completed and indicates no significant adverse effects on deliveries of water to other users.

Agency	Program/ Project	Status	Description of Program/Project	Effects on Water Supply
Davis, Woodland, and University of California, Davis	Davis-Woodland Water Supply Project	Program under development. Final EIR in 2009. Specific design and operations criteria not identified.	Project that will divert water on the Sacramento River upstream of the American River confluence to be conveyed to a new water treatment plant (City of Davis 2007).	Water diversions under the Davis-Woodland Water Supply Project would be made in compliance with Standard Water Right Permit Term 91, which prohibits surface water diversions when water is being released from CVP or SWP storage reservoirs to meet in-basin entitlements, including water quality and environmental standards for protection of the Sacramento-San Joaquin Delta. Water supply needs during periods applicable to Term 91 would be satisfied by entering into water supply transfer agreements with senior water rights holders within the Sacramento River watershed. The total diversion would be less than 50,000 acre-feet/year. An environmental impact report has been completed and indicates no significant adverse effects on Sacramento River hydrologic conditions or Delta inflow and/or outflow in a way that would conflict with other water management objectives or existing beneficial uses and that the project operation would not infringe upon the water rights of other legal users of water.
U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Department of Water Resources, and Department of Fish and Wildlife	San Joaquin River Restoration Program	Final EIS/EIR completed in 2012.	Program that aims at restoring self-sustaining fish populations in the San Joaquin River below Friant Dam to the confluence of Merced River and to implement water management actions for the Friant Division water users (Bureau of Reclamation 2011).	The San Joaquin River Restoration Program is a direct result of a September 2006 legal settlement by the U.S. Departments of the Interior and Commerce, the Natural Resources Defense Council, and the Friant Water Users Authority to restore spring and fall run Chinook salmon to the San Joaquin River below Friant Dam while supporting water management actions within the Friant Division. Public Law 111-11 authorized and directed federal agencies to implement the settlement. Interim flows began October 1, 2009, and full restoration flows are scheduled to begin no later than January 2014 (California Department of Water Resources 2009: SJ-12) The SJRRP would modify the release pattern of water from Friant Dam into the San Joaquin River, implement a combination of channel and structural modifications along the San Joaquin River below Friant Dam, and reintroduce Chinook salmon into portions of the San Joaquin River. Part or all of water released from Friant Dam could be recirculated to upstream water users. A draft environmental impact report has been completed and indicates no significant adverse effects on surface water supplies.

All of these projects have completed draft or final environmental documents that analyzed their potential impacts on water supplies. According to these documents, the impacts on water supplies would be less than significant or less than significant after mitigation measures are implemented.

No Action Alternative

The effects of sea level rise and climate change, increase in north of Delta urban demands and implementation of Fall X2 in wet and above normal years under the No Action Alternative would cause cumulative changes in SWP and CVP deliveries as compared to Existing Conditions. Similar effects from sea level rise and climate change would also occur under the action alternatives. Average annual total CVP deliveries would cumulatively decrease by 172 TAF (4%) and average annual total south of the Delta CVP deliveries would decrease by about 280 TAF (13%) as compared to deliveries under Existing Conditions. Average annual CVP north of Delta agricultural deliveries would be reduced by 73 TAF (31%) and exhibit cumulative reductions in about 95% of years under the No Action Alternative as compared to Existing Conditions, as shown in Figure 5-30. Average annual CVP south of Delta agricultural deliveries would be reduced by 240 TAF (25%) and exhibit cumulative reductions in about 90% of the years, as shown in Figure 5-31. Average annual CVP north of Delta M&I deliveries would increase by 171 TAF (81%) due to the increase in urban demand as described in section 5.3.3.1. Deliveries would cumulatively increase in all years, as shown in Figure 5-32. Average annual CVP south of Delta M&I deliveries would be reduced by 13 TAF (11%) in about 95% of the years, as shown in Figure 5-33.

Model results show a 52 TAF (3%) cumulative decrease in CVP Settlement Contract deliveries and a 21 TAF (5%) cumulative decrease in CVP Level 2 Refuge Water Supplies during dry and critical years compared to the Existing Conditions. This is because Shasta Lake storage would decline to dead pool more frequently due to the shift in runoff patterns from climate change, increased releases for Fall X2, and increased demands as explained above. Results show no cumulative changes in deliveries to CVP Exchange Contractors. As described in the methods section, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

Average annual total SWP deliveries would decline by 394 TAF (11%). Average annual total SWP south of Delta deliveries (including Article 56[19] and Article 21) would be reduced by about 370 TAF (14%) and exhibit reductions in about 95% of the years under No Action Alternative as compared to Existing Conditions, as shown in Figure 5-34. Average annual SWP Table A deliveries would reduce by 264 TAF (10%) and average annual SWP south of Delta Table A deliveries (including Article 56) would be reduced by about 275 TAF (11%). South of Delta Table A deliveries would be reduced in about 95% of the years, as shown in Figure 5-35. Average annual SWP south of Delta Article 21 deliveries would be reduced by about 111 TAF (70%) and would decrease in almost all years, as shown in Figure 5-36. There would be an average annual decrease of 55 TAF (6%) in SWP Feather River Service Area deliveries during dry and critical years compared to the Existing Conditions.

[19] In accordance with Monterey Agreement Article 56, SWP contractors may choose to keep a portion of their allocated water in a certain year in project surface conservation facilities and request it in a subsequent year. Article 56 deliveries in this document refers to water that was previously stored in project storage facilities delivered to contractors in a certain year.

Overall, SWP and CVP water deliveries would cumulatively decrease under the No Action Alternative as compared to Existing Conditions.

Action Alternatives

Impact WS-4: Cumulative Change in Delta Exports

Delta exports would change under implementation of the BDCP alternatives, as previously described in this chapter. Implementation of BDCP Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in reductions in Delta exports as compared to Existing Conditions and No Action Alternative as described in Sections 5.3.3.2 through 5.3.3.10 and Section 5.3.3.16. Implementation of Alternatives 6A, 6B, 6C, 7, and 8 would result in reductions in Delta exports as compared to Existing Conditions and No Action Alternative as described in Sections 5.3.3.11 through 5.3.3.15. Indirect effects of changes in Delta exports are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Implementation of the projects and programs listed in Table 5-8 could modify stream flows in the Sacramento and/or San Joaquin rivers. However, the changes that would occur in stream flows would be within operational ranges projected to occur under any of the BDCP alternatives. Overall, there could be changes in diversion patterns throughout the year.

NEPA Effects: Implementation of these projects in combination with 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in cumulative effects. Implementation of these projects in combination with Alternatives 6A, 6B, 6C, 7, and 8 would result in cumulative effects (reduction in exports). Indirect physical effects of changes in Delta exports are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion: Implementation of BDCP Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in reductions in Delta exports. Implementation of the projects listed in Table 5-8 in combination with Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in cumulative effects.

Implementation of BDCP Alternatives 6A, 6B, 6C, 7, and 8 would result in reductions in Delta exports. Implementation of the projects listed in Table 5-8 in combination with Alternatives 6A, 6B, 6C, 7, and 8 would result in cumulative effects on water supply. The indirect physical effects of these changes in Delta exports are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-5: Cumulative Change in SWP and CVP Deliveries

SWP and CVP deliveries would change under implementation of the BDCP alternatives, as previously described in this chapter. Implementation of BDCP Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in reductions in SWP and CVP deliveries as compared to Existing Conditions and No Action Alternative as described in Sections 5.3.3.2 through 5.3.3.10 and Section 5.3.3.16. Implementation of Alternatives 6A, 6B, 6C, 7, and 8 would result in reductions in SWP and CVP deliveries as compared to Existing Conditions and No Action Alternative as described in Sections 5.3.3.11 through 5.3.3.15.

Implementation of the projects and programs listed in Table 5-8 could modify stream flows in the Sacramento and/or San Joaquin rivers. However, the changes that would occur in stream flows would be within operational ranges projected to occur under any of the BDCP alternatives. Overall, there could be changes in diversion patterns throughout the year.

NEPA Effects: Implementation of these projects in combination with Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in cumulative effects. Implementation of these projects in combination with Alternatives 6A, 6B, 6C, 7, and 8 would result in cumulative effects (reduction in deliveries). Indirect effects of changes in Delta exports are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion**:** Implementation of BDCP Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in reductions in SWP and CVP deliveries. Implementation of the projects listed in Table 5-8 in combination with Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in cumulative effects.

Implementation of BDCP Alternatives 6A, 6B, 6C, 7, and 8 would result in reductions in SWP and CVP deliveries. Implementation of the projects listed in Table 5-8 in combination with Alternatives 6A, 6B, 6C, 7, and 8 would result in cumulative water supply effects. The indirect physical effects of these changes in Delta exports are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

Impact WS-6: Cumulative Effects of Water Transfers on Water Supply

To the extent that implementation of the projects listed in Table 5-8 reduces SWP and CVP deliveries, there would be a cumulative effect on cross-Delta water transfers evidenced as an increase in the frequency of water transfer demands and an increase in the average annual cross-Delta transfers.

NEPA Effects: Implementation of these projects in combination with Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in cumulative effects. Implementation of these projects in combination with Alternatives 6A, 6B, 6C, 7, and 8 would result in cumulative effects (increased frequency of transfers and increased transfer volumes). Indirect effects of changes in Delta exports are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

CEQA Conclusion**:** Implementation of BDCP Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in reductions in SWP and CVP deliveries. Implementation of the projects listed in Table 5-8 in combination with Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, and 9 would not result in cumulative effects.

Implementation of BDCP Alternatives 6A, 6B, 6C, 7, and 8 would result in reductions in SWP and CVP deliveries and would increase the frequency of transfers and increase transfer volumes. The indirect physical effects of these changes in Delta exports are addressed in Chapter 30, *Growth Inducement and Other Indirect Effects,* and other chapters addressing specific resources.

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Table 5-4. Water Supply Summary Table

Location	Parameter	Units	Existing Condition	No Action Alternative (LLT)	Alternative 1A,1B,1C (LLT)	Alternative 2A,2B,2C (LLT)	Alternative 3 (LLT)	Alternative 5 (LLT)	Alternative 6A,6B,6C (LLT)	Alternative 7 (LLT)	Alternative 8 (LLT)	Alternative 9 (LLT)
Trinity Lake	End of Sep Storage	TAF	1,393	1,163	1,125	1,132	1,130	1,143	1,184	1,160	1,183	1,165
Shasta Lake	End of Sep Storage	TAF	2,723	2,242	2,284	2,180	2,284	2,189	2,314	2,211	2,284	2,235
Lake Oroville	End of Sep Storage	TAF	2,054	1,408	1,762	1,486	1,756	1,537	1,640	1,642	1,537	1,405
Folsom Lake	End of Sep Storage	TAF	525	379	400	371	397	363	399	369	373	390
CVP North-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	234	161	179	164	178	162	142	136	132	141
CVP South-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	967	727	956	830	951	823	573	577	486	705
CVP North-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	210	381	384	382	384	380	385	380	373	376
CVP South-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	118	105	114	109	115	109	90	90	61	105
CVP Settlement Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	1,823	1,770	1,767	1,763	1,766	1,768	1,788	1,759	1,730	1,769
CVP Exchange Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	814	814	814	814	814	814	806	804	805	814
CVP Level 2 Refuge Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	397	376	372	366	378	373	329	326	290	381
Total CVP South-of-Delta Deliveries (including AG, M&I, Exchange & Refuge)	Annual (Mar-Feb)	TAF	2,233	1,953	2,190	2,058	2,188	2,053	1,764	1,766	1,631	1,934
Total CVP Deliveries (including AG, M&I, Settlemnt, Exchange & Refuge)	Annual (Mar-Feb)	TAF	4,649	4,477	4,740	4,585	4,735	4,577	4,275	4,256	4,094	4,433
Total SWP Contractors Deliveries (including FRSA, Table A, A56 and A21)	Annual (Jan-Dec)	TAF	3,736	3,342	4,112	3,854	4,027	3,596	2,904	2,920	2,352	3,311
SWP South-of-Delta Contractors Deliveries (including Table A, A56 and A21)	Annual (Jan-Dec)	TAF	2,707	2,337	3,088	2,834	3,005	2,583	1,902	1,918	1,430	2,302
Total SWP Contractors Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	2,629	2,365	2,931	2,764	2,885	2,587	1,887	1,951	1,430	2,349
SWP Contractors South-of-Delta Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	2,576	2,301	2,851	2,687	2,806	2,516	1,833	1,895	1,391	2,281
SWP Contractors A21 Deliveries	Annual (Jan-Dec)	TAF	158	47	248	157	210	79	81	35	48	33
SWP FRSA Deliveries	Dry and Critical Annual (Jan-Dec)	TAF	899	845	856	857	856	848	862	856	729	847
Delta Outflow	Annual (Oct-Sep)	TAF	15,533	16,282	15,210	15,638	15,305	15,933	16,916	16,965	17,727	16,339
Delta Exports	Annual (Oct-Sep)	TAF	5,144	4,441	5,456	5,068	5,371	4,786	3,758	3,754	3,098	4,377
Exports at North Delta Diversion Intakes	Annual (Oct-Sep)	%	0	0	50	58	35	25	100	62	70	0
Exports at South Delta Intakes	Annual (Oct-Sep)	%	100	100	50	42	65	75	0	38	30	100

Note: "LLT" (Late Long-Term) indicates Alternatives that are simulated with 2060 climate change and sea level rise.

Table 5-5. Water Supply Summary Table - Differences from Existing Conditions

Location	Parameter	Units	No Action Alternative (LLT)	Alternative 1A,1B,1C (LLT)	Alternative 2A,2B,2C (LLT)	Alternative 3 (LLT)	Alternative 5 (LLT)	Alternative 6A,6B,6C (LLT)	Alternative 7 (LLT)	Alternative 8 (LLT)	Alternative 9 (LLT)
Trinity Lake	End of Sep Storage	TAF	-230	-269	-261	-263	-250	-210	-234	-211	-228
Shasta Lake	End of Sep Storage	TAF	-481	-438	-542	-439	-534	-409	-511	-438	-488
Lake Oroville	End of Sep Storage	TAF	-646	-292	-568	-298	-517	-414	-412	-517	-649
Folsom Lake	End of Sep Storage	TAF	-146	-125	-154	-128	-162	-126	-157	-152	-135
CVP North-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	-73	-55	-70	-56	-72	-92	-97	-102	-92
CVP South-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	-240	-11	-137	-17	-144	-395	-390	-481	-262
CVP North-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	171	174	172	174	170	174	170	163	166
CVP South-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	-13	-3	-8	-3	-9	-27	-28	-57	-12
CVP Settlement Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	-52	-55	-60	-57	-54	-35	-64	-92	-54
CVP Exchange Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	0	0	0	0	0	-9	-10	-9	0
CVP Level 2 Refuge Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	-21	-25	-31	-20	-24	-68	-71	-107	-16
Total CVP South-of-Delta Deliveries (including AG, M&I, Exchange & Refuge)	Annual (Mar-Feb)	TAF	-280	-43	-175	-46	-180	-469	-467	-602	-300
Total CVP Deliveries (including AG, M&I, Settlemnt, Exchange & Refuge)	Annual (Mar-Feb)	TAF	-172	90	-64	86	-72	-374	-393	-556	-216
Total SWP Contractors Deliveries (including FRSA, Table A, A56 and A21)	Annual (Jan-Dec)	TAF	-394	376	118	292	-139	-832	-816	-1,384	-424
SWP South-of-Delta Contractors Deliveries (including Table A, A56 and A21)	Annual (Jan-Dec)	TAF	-370	381	127	298	-124	-806	-789	-1,277	-405
Total SWP Contractors Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	-264	302	135	256	-41	-742	-677	-1,199	-280
SWP Contractors South-of-Delta Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	-275	275	111	230	-59	-743	-681	-1,185	-295
SWP Contractors A21 Deliveries	Annual (Jan-Dec)	TAF	-111	89	-2	51	-80	-77	-123	-111	-125
SWP FRSA Deliveries	Dry and Critical Annual (Jan-Dec)	TAF	-55	-44	-43	-43	-51	-37	-43	-171	-52
Delta Outflow	Annual (Oct-Sep)	TAF	750	-323	105	-227	401	1,383	1,433	2,195	807
Delta Exports	Annual (Oct-Sep)	TAF	-703	312	-76	227	-358	-1,386	-1,389	-2,046	-766
Exports at North Delta Diversion Intakes	Annual (Oct-Sep)	%	0	50	58	35	25	100	62	70	0
Exports at South Delta Intakes	Annual (Oct-Sep)	%	0	-50	-58	-35	-25	-100	-62	-70	0

Water Supply Summary Table - Percent Differences from Existing Conditions

Location	Parameter	Units	No Action Alternative (LLT)	Alternative 1A,1B,1C (LLT)	Alternative 2A,2B,2C (LLT)	Alternative 3 (LLT)	Alternative 5 (LLT)	Alternative 6A,6B,6C (LLT)	Alternative 7 (LLT)	Alternative 8 (LLT)	Alternative 9 (LLT)
Trinity Lake	End of Sep Storage	%	-17	-19	-19	-19	-18	-15	-17	-15	-16
Shasta Lake	End of Sep Storage	%	-18	-16	-20	-16	-20	-15	-19	-16	-18
Lake Oroville	End of Sep Storage	%	-31	-14	-28	-14	-25	-20	-20	-25	-32
Folsom Lake	End of Sep Storage	%	-28	-24	-29	-24	-31	-24	-30	-29	-26
CVP North-of-Delta AG Deliveries	Annual (Mar-Feb)	%	-31	-23	-30	-24	-31	-39	-42	-44	-40
CVP South-of-Delta AG Deliveries	Annual (Mar-Feb)	%	-25	-1	-14	-2	-15	-41	-40	-50	-27
CVP North-of-Delta M&I Deliveries	Annual (Mar-Feb)	%	81	83	82	83	81	83	81	77	79
CVP South-of-Delta M&I Deliveries	Annual (Mar-Feb)	%	-11	-3	-7	-2	-7	-23	-23	-49	-10
CVP Settlement Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	%	-3	-3	-3	-3	-3	-2	-4	-5	-3
CVP Exchange Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	%	0	0	0	0	0	-1	-1	-1	0
CVP Level 2 Refuge Deliveries	Dry and Critical Annual (Mar-Feb)	%	-5	-6	-8	-5	-6	-17	-18	-27	-4
Total CVP South-of-Delta Deliveries (including AG, M&I, Exchange & Refuge)	Annual (Mar-Feb)	%	-13	-2	-8	-2	-8	-21	-21	-27	-13
Total CVP Deliveries (including AG, M&I, Settlemnt, Exchange & Refuge)	Annual (Mar-Feb)	%	-4	2	-1	2	-2	-8	-8	-12	-5
Total SWP Contractors Deliveries (including FRSA, Table A, A56 and A21)	Annual (Jan-Dec)	%	-11	10	3	8	-4	-22	-22	-37	-11
SWP South-of-Delta Contractors Deliveries (including Table A, A56 and A21)	Annual (Jan-Dec)	%	-14	14	5	11	-5	-30	-29	-47	-15
Total SWP Contractors Table A Deliveries (including A56)	Annual (Jan-Dec)	%	-10	12	5	10	-2	-28	-26	-46	-11
SWP Contractors South-of-Delta Table A Deliveries (including A56)	Annual (Jan-Dec)	%	-11	11	4	9	-2	-29	-26	-46	-11
SWP Contractors A21 Deliveries	Annual (Jan-Dec)	%	-70	56	-1	32	-50	-49	-78	-70	-79
SWP FRSA Deliveries	Dry and Critical Annual (Jan-Dec)	%	-6	-5	-5	-5	-6	-4	-5	-19	-6
Delta Outflow	Annual (Oct-Sep)	%	5	-2	1	-1	3	9	9	14	5
Delta Exports	Annual (Oct-Sep)	%	-14	6	-1	4	-7	-27	-27	-40	-15
Exports at North Delta Diversion Intakes	Annual (Oct-Sep)	%	-	-	-	-	-	-	-	-	-
Exports at South Delta Intakes	Annual (Oct-Sep)	%	0	-50	-58	-35	-25	-100	-62	-70	0

Note: "LLT" (Late Long-Term) indicates Alternatives that are simulated with 2060 climate change and sea level rise.

Table 5-6. Water Supply Summary Table - Differences from No Action Alternative (LLT)

Location	Parameter	Units	Alternative 1A,1B,1C (LLT)	Alternative 2A,2B,2C (LLT)	Alternative 3 (LLT)	Alternative 5 (LLT)	Alternative 6A,6B,6C (LLT)	Alternative 7 (LLT)	Alternative 8 (LLT)	Alternative 9 (LLT)
Trinity Lake	End of Sep Storage	TAF	-38	-31	-33	-20	21	-3	20	2
Shasta Lake	End of Sep Storage	TAF	43	-61	42	-53	72	-30	43	-7
Lake Oroville	End of Sep Storage	TAF	354	78	349	130	232	234	130	-3
Folsom Lake	End of Sep Storage	TAF	21	-8	18	-16	20	-11	-6	10
CVP North-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	18	3	17	1	-19	-25	-29	-20
CVP South-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	229	103	223	96	-155	-150	-241	-22
CVP North-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	3	1	3	-1	3	-1	-9	-5
CVP South-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	10	5	10	4	-15	-15	-44	1
CVP Settlement Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	-3	-8	-5	-2	17	-12	-40	-2
CVP Exchange Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	0	0	0	0	-8	-10	-9	0
CVP Level 2 Refuge Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	-4	-10	2	-3	-47	-50	-86	5
Total CVP South-of-Delta Deliveries (including AG, M&I, Exchange & Refuge)	Annual (Mar-Feb)	TAF	237	105	234	100	-189	-187	-323	-20
Total CVP Deliveries (including AG, M&I, Settlemnt, Exchange & Refuge)	Annual (Mar-Feb)	TAF	263	108	258	100	-202	-221	-383	-44
Total SWP Contractors Deliveries (including FRSA, Table A, A56 and A21)	Annual (Jan-Dec)	TAF	770	512	686	255	-438	-422	-990	-30
SWP South-of-Delta Contractors Deliveries (including Table A, A56 and A21)	Annual (Jan-Dec)	TAF	751	497	668	246	-436	-419	-907	-35
Total SWP Contractors Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	566	399	519	222	-478	-414	-935	-17
SWP Contractors South-of-Delta Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	550	386	505	215	-468	-406	-910	-20
SWP Contractors A21 Deliveries	Annual (Jan-Dec)	TAF	200	110	162	31	34	-12	0	-14
SWP FRSA Deliveries	Dry and Critical Annual (Jan-Dec)	TAF	11	12	12	4	18	12	-116	3
Delta Outflow	Annual (Oct-Sep)	TAF	-1,072	-645	-977	-349	633	683	1,445	57
Delta Exports	Annual (Oct-Sep)	TAF	1,016	628	930	346	-682	-686	-1,342	-63
Exports at North Delta Diversion Intakes	Annual (Oct-Sep)	%	50	58	35	25	100	62	70	0
Exports at South Delta Intakes	Annual (Oct-Sep)	%	-50	-58	-35	-25	-100	-62	-70	0

Water Supply Summary Table - Percent Differences from No Action Alternative (LLT)

Location	Parameter	Units	Alternative 1A,1B,1C (LLT)	Alternative 2A,2B,2C (LLT)	Alternative 3 (LLT)	Alternative 5 (LLT)	Alternative 6A,6B,6C (LLT)	Alternative 7 (LLT)	Alternative 8 (LLT)	Alternative 9 (LLT)
Trinity Lake	End of Sep Storage	%	-3	-3	-3	-2	2	0	2	0
Shasta Lake	End of Sep Storage	%	2	-3	2	-2	3	-1	2	0
Lake Oroville	End of Sep Storage	%	25	6	25	9	16	17	9	0
Folsom Lake	End of Sep Storage	%	5	-2	5	-4	5	-3	-2	3
CVP North-of-Delta AG Deliveries	Annual (Mar-Feb)	%	11	2	11	1	-12	-15	-18	-12
CVP South-of-Delta AG Deliveries	Annual (Mar-Feb)	%	31	14	31	13	-21	-21	-33	-3
CVP North-of-Delta M&I Deliveries	Annual (Mar-Feb)	%	1	0	1	0	1	0	-2	-1
CVP South-of-Delta M&I Deliveries	Annual (Mar-Feb)	%	9	4	10	4	-14	-14	-42	1
CVP Settlement Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	%	0	0	0	0	1	-1	-2	0
CVP Exchange Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	%	0	0	0	0	-1	-1	-1	0
CVP Level 2 Refuge Deliveries	Dry and Critical Annual (Mar-Feb)	%	-1	-3	0	-1	-12	-13	-23	1
Total CVP South-of-Delta Deliveries (including AG, M&I, Exchange & Refuge)	Annual (Mar-Feb)	%	12	5	12	5	-10	-10	-17	-1
Total CVP Deliveries (including AG, M&I, Settlemnt, Exchange & Refuge)	Annual (Mar-Feb)	%	6	2	6	2	-5	-5	-9	-1
Total SWP Contractors Deliveries (including FRSA, Table A, A56 and A21)	Annual (Jan-Dec)	%	23	15	21	8	-13	-13	-30	-1
SWP South-of-Delta Contractors Deliveries (including Table A, A56 and A21)	Annual (Jan-Dec)	%	32	21	29	11	-19	-18	-39	-1
Total SWP Contractors Table A Deliveries (including A56)	Annual (Jan-Dec)	%	24	17	22	9	-20	-17	-40	-1
SWP Contractors South-of-Delta Table A Deliveries (including A56)	Annual (Jan-Dec)	%	24	17	22	9	-20	-18	-40	-1
SWP Contractors A21 Deliveries	Annual (Jan-Dec)	%	423	231	343	66	72	-26	0	-30
SWP FRSA Deliveries	Dry and Critical Annual (Jan-Dec)	%	1	1	1	0	2	1	-14	0
Delta Outflow	Annual (Oct-Sep)	%	-7	-4	-6	-2	4	4	9	0
Delta Exports	Annual (Oct-Sep)	%	23	14	21	8	-15	-15	-30	-1
Exports at North Delta Diversion Intakes	Annual (Oct-Sep)	%	-	-	-	-	-	-	-	-
Exports at South Delta Intakes	Annual (Oct-Sep)	%	-50	-58	-35	-25	-100	-62	-70	0

Note: "LLT" (Late Long-Term) indicates Alternatives that are simulated with 2060 climate change and sea level rise.

Table 5-7. Water Supply Summary Table

Location	Parameter	Units	Existing Condition	No Action Alternative (LLT)	Alternative 4 H1 (LLT)	Alternative 4 H2 (LLT)	Alternative 4 H3 (LLT)	Alternative 4 H4 (LLT)
Trinity Lake	End of Sep Storage	TAF	1,393	1,163	1,165	1,186	1,139	1,160
Shasta Lake	End of Sep Storage	TAF	2,723	2,242	2,327	2,384	2,181	2,229
Lake Oroville	End of Sep Storage	TAF	2,054	1,408	1,658	1,713	1,474	1,551
Folsom Lake	End of Sep Storage	TAF	525	379	394	422	371	380
CVP North-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	234	161	180	178	165	162
CVP South-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	967	727	940	915	821	796
CVP North-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	210	381	388	387	382	382
CVP South-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	118	105	114	114	109	109
CVP Settlement Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	1,823	1,770	1,765	1,792	1,763	1,794
CVP Exchange Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	814	814	814	814	814	814
CVP Level 2 Refuge Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	397	376	374	377	369	375
Total CVP South-of-Delta Deliveries (including AG, M&I, Exchange & Refuge)	Annual (Mar-Feb)	TAF	2,233	1,953	2,175	2,150	2,050	2,026
Total CVP Deliveries (including AG, M&I, Settlemnt, Exchange & Refuge)	Annual (Mar-Feb)	TAF	4,649	4,477	4,728	4,706	4,579	4,560
Total SWP Contractors Deliveries (including FRSA, Table A, A56 and A21)	Annual (Jan-Dec)	TAF	3,736	3,342	3,923	3,422	3,742	3,251
SWP South-of-Delta Contractors Deliveries (including Table A, A56 and A21)	Annual (Jan-Dec)	TAF	2,707	2,337	2,903	2,414	2,726	2,243
Total SWP Contractors Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	2,629	2,365	2,855	2,351	2,704	2,191
SWP Contractors South-of-Delta Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	2,576	2,301	2,776	2,287	2,629	2,130
SWP Contractors A21 Deliveries	Annual (Jan-Dec)	TAF	158	47	138	139	107	126
SWP FRSA Deliveries	Dry and Critical Annual (Jan-Dec)	TAF	899	845	849	855	850	861
Delta Outflow	Annual (Oct-Sep)	TAF	15,533	16,282	15,418	15,937	15,767	16,277
Delta Exports	Annual (Oct-Sep)	TAF	5,144	4,441	5,255	4,710	4,945	4,414
Exports at North Delta Diversion Intakes	Annual (Oct-Sep)	%	0	0	47	46	49	49
Exports at South Delta Intakes	Annual (Oct-Sep)	%	100	100	53	54	51	51

Note: "LLT" (Late Long-Term) indicates Alternatives that are simulated with 2060 climate change and sea level rise.

Table 5-8. Water Supply Summary Table - Differences from Existing Conditions

Location	Parameter	Units	No Action Alternative (LLT)	Alternative 4 H1 (LLT)	Alternative 4 H2 (LLT)	Alternative 4 H3 (LLT)	Alternative 4 H4 (LLT)
Trinity Lake	End of Sep Storage	TAF	-230	-228	-207	-255	-233
Shasta Lake	End of Sep Storage	TAF	-481	-396	-339	-541	-493
Lake Oroville	End of Sep Storage	TAF	-646	-396	-341	-580	-503
Folsom Lake	End of Sep Storage	TAF	-146	-131	-103	-154	-145
CVP North-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	-73	-54	-56	-69	-72
CVP South-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	-240	-27	-52	-146	-171
CVP North-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	171	178	177	172	172
CVP South-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	-13	-4	-4	-8	-9
CVP Settlement Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	-52	-57	-31	-59	-29
CVP Exchange Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	0	0	0	0	0
CVP Level 2 Refuge Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	-21	-23	-20	-28	-22
Total CVP South-of-Delta Deliveries (including AG, M&I, Exchange & Refuge)	Annual (Mar-Feb)	TAF	-280	-59	-83	-183	-207
Total CVP Deliveries (including AG, M&I, Settlemnt, Exchange & Refuge)	Annual (Mar-Feb)	TAF	-172	79	57	-71	-90
Total SWP Contractors Deliveries (including FRSA, Table A, A56 and A21)	Annual (Jan-Dec)	TAF	-394	187	-314	6	-485
SWP South-of-Delta Contractors Deliveries (including Table A, A56 and A21)	Annual (Jan-Dec)	TAF	-370	196	-294	19	-464
Total SWP Contractors Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	-264	226	-277	75	-438
SWP Contractors South-of-Delta Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	-275	201	-288	53	-446
SWP Contractors A21 Deliveries	Annual (Jan-Dec)	TAF	-111	-20	-20	-51	-33
SWP FRSA Deliveries	Dry and Critical Annual (Jan-Dec)	TAF	-55	-50	-44	-50	-38
Delta Outflow	Annual (Oct-Sep)	TAF	750	-114	405	234	744
Delta Exports	Annual (Oct-Sep)	TAF	-703	112	-434	-199	-730
Exports at North Delta Diversion Intakes	Annual (Oct-Sep)	%	0	47	46	49	49
Exports at South Delta Intakes	Annual (Oct-Sep)	%	0	-47	-46	-49	-49

Water Supply Summary Table - Percent Differences from Existing Conditions

Location	Parameter	Units	No Action Alternative (LLT)	Alternative 4 H1 (LLT)	Alternative 4 H2 (LLT)	Alternative 4 H3 (LLT)	Alternative 4 H4 (LLT)
Trinity Lake	End of Sep Storage	%	-17	-16	-15	-18	-17
Shasta Lake	End of Sep Storage	%	-18	-15	-12	-20	-18
Lake Oroville	End of Sep Storage	%	-31	-19	-17	-28	-24
Folsom Lake	End of Sep Storage	%	-28	-25	-20	-29	-28
CVP North-of-Delta AG Deliveries	Annual (Mar-Feb)	%	-31	-23	-24	-29	-31
CVP South-of-Delta AG Deliveries	Annual (Mar-Feb)	%	-25	-3	-5	-15	-18
CVP North-of-Delta M&I Deliveries	Annual (Mar-Feb)	%	81	85	84	82	82
CVP South-of-Delta M&I Deliveries	Annual (Mar-Feb)	%	-11	-3	-3	-7	-7
CVP Settlement Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	%	-3	-3	-2	-3	-2
CVP Exchange Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	%	0	0	0	0	0
CVP Level 2 Refuge Deliveries	Dry and Critical Annual (Mar-Feb)	%	-5	-6	-5	-7	-6
Total CVP South-of-Delta Deliveries (including AG, M&I, Exchange & Refuge)	Annual (Mar-Feb)	%	-13	-3	-4	-8	-9
Total CVP Deliveries (including AG, M&I, Settlemnt, Exchange & Refuge)	Annual (Mar-Feb)	%	-4	2	1	-2	-2
Total SWP Contractors Deliveries (including FRSA, Table A, A56 and A21)	Annual (Jan-Dec)	%	-11	5	-8	0	-13
SWP South-of-Delta Contractors Deliveries (including Table A, A56 and A21)	Annual (Jan-Dec)	%	-14	7	-11	1	-17
Total SWP Contractors Table A Deliveries (including A56)	Annual (Jan-Dec)	%	-10	9	-11	3	-17
SWP Contractors South-of-Delta Table A Deliveries (including A56)	Annual (Jan-Dec)	%	-11	8	-11	2	-17
SWP Contractors A21 Deliveries	Annual (Jan-Dec)	%	-70	-13	-13	-32	-21
SWP FRSA Deliveries	Dry and Critical Annual (Jan-Dec)	%	-6	-6	-5	-6	-4
Delta Outflow	Annual (Oct-Sep)	%	5	-1	3	2	5
Delta Exports	Annual (Oct-Sep)	%	-14	2	-8	-4	-14
Exports at North Delta Diversion Intakes	Annual (Oct-Sep)	%	-	-	-	-	-
Exports at South Delta Intakes	Annual (Oct-Sep)	%	0	-47	-46	-49	-49

Note: "LLT" (Late Long-Term) indicates Alternatives that are simulated with 2060 climate change and sea level rise.

Table 5-9. Water Supply Summary Table - Differences from No Action Alternative (LLT)

Location	Parameter	Units	Alternative 4 H1 (LLT)	Alternative 4 H2 (LLT)	Alternative 4 H3 (LLT)	Alternative 4 H4 (LLT)
Trinity Lake	End of Sep Storage	TAF	2	23	-24	-3
Shasta Lake	End of Sep Storage	TAF	85	142	-60	-12
Lake Oroville	End of Sep Storage	TAF	250	305	66	144
Folsom Lake	End of Sep Storage	TAF	15	43	-8	1
CVP North-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	19	17	4	1
CVP South-of-Delta AG Deliveries	Annual (Mar-Feb)	TAF	213	188	94	69
CVP North-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	7	6	1	1
CVP South-of-Delta M&I Deliveries	Annual (Mar-Feb)	TAF	9	9	4	4
CVP Settlement Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	-5	22	-7	23
CVP Exchange Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	0	0	0	0
CVP Level 2 Refuge Deliveries	Dry and Critical Annual (Mar-Feb)	TAF	-2	1	-6	-1
Total CVP South-of-Delta Deliveries (including AG, M&I, Exchange & Refuge)	Annual (Mar-Feb)	TAF	221	197	97	73
Total CVP Deliveries (including AG, M&I, Settlemnt, Exchange & Refuge)	Annual (Mar-Feb)	TAF	251	229	102	83
Total SWP Contractors Deliveries (including FRSA, Table A, A56 and A21)	Annual (Jan-Dec)	TAF	582	80	400	-91
SWP South-of-Delta Contractors Deliveries (including Table A, A56 and A21)	Annual (Jan-Dec)	TAF	566	77	389	-94
Total SWP Contractors Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	489	-14	339	-175
SWP Contractors South-of-Delta Table A Deliveries (including A56)	Annual (Jan-Dec)	TAF	475	-14	328	-171
SWP Contractors A21 Deliveries	Annual (Jan-Dec)	TAF	91	91	60	78
SWP FRSA Deliveries	Dry and Critical Annual (Jan-Dec)	TAF	5	10	5	17
Delta Outflow	Annual (Oct-Sep)	TAF	-864	-345	-516	-5
Delta Exports	Annual (Oct-Sep)	TAF	815	269	505	-27
Exports at North Delta Diversion Intakes	Annual (Oct-Sep)	%	47	46	49	49
Exports at South Delta Intakes	Annual (Oct-Sep)	%	-47	-46	-49	-49

Water Supply Summary Table - Percent Differences from No Action Alternative (LLT)

Location	Parameter	Units	Alternative 4 H1 (LLT)	Alternative 4 H2 (LLT)	Alternative 4 H3 (LLT)	Alternative 4 H4 (LLT)
Trinity Lake	End of Sep Storage	%	0	2	-2	0
Shasta Lake	End of Sep Storage	%	4	6	-3	-1
Lake Oroville	End of Sep Storage	%	18	22	5	10
Folsom Lake	End of Sep Storage	%	4	11	-2	0
CVP North-of-Delta AG Deliveries	Annual (Mar-Feb)	%	12	10	2	1
CVP South-of-Delta AG Deliveries	Annual (Mar-Feb)	%	29	26	13	9
CVP North-of-Delta M&I Deliveries	Annual (Mar-Feb)	%	2	1	0	0
CVP South-of-Delta M&I Deliveries	Annual (Mar-Feb)	%	9	8	4	4
CVP Settlement Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	%	0	1	0	1
CVP Exchange Contractors Deliveries	Dry and Critical Annual (Mar-Feb)	%	0	0	0	0
CVP Level 2 Refuge Deliveries	Dry and Critical Annual (Mar-Feb)	%	-1	0	-2	0
Total CVP South-of-Delta Deliveries (including AG, M&I, Exchange & Refuge)	Annual (Mar-Feb)	%	11	10	5	4
Total CVP Deliveries (including AG, M&I, Settlemnt, Exchange & Refuge)	Annual (Mar-Feb)	%	6	5	2	2
Total SWP Contractors Deliveries (including FRSA, Table A, A56 and A21)	Annual (Jan-Dec)	%	17	2	12	-3
SWP South-of-Delta Contractors Deliveries (including Table A, A56 and A21)	Annual (Jan-Dec)	%	24	3	17	-4
Total SWP Contractors Table A Deliveries (including A56)	Annual (Jan-Dec)	%	21	-1	14	-7
SWP Contractors South-of-Delta Table A Deliveries (including A56)	Annual (Jan-Dec)	%	21	-1	14	-7
SWP Contractors A21 Deliveries	Annual (Jan-Dec)	%	192	193	126	165
SWP FRSA Deliveries	Dry and Critical Annual (Jan-Dec)	%	1	1	1	2
Delta Outflow	Annual (Oct-Sep)	%	-5	-2	-3	0
Delta Exports	Annual (Oct-Sep)	%	18	6	11	-1
Exports at North Delta Diversion Intakes	Annual (Oct-Sep)	%	-	-	-	-
Exports at South Delta Intakes	Annual (Oct-Sep)	%	-47	-46	-49	-49

Note: "LLT" (Late Long-Term) indicates Alternatives that are simulated with 2060 climate change and sea level rise.