Appendix 3A

No Action Alternative: Central Valley Project and State Water Project Operations

3A.1 Overview of the Central Valley Project and State Water Project

The Central Valley Project (CVP), operated by Bureau of Reclamation (Reclamation), and the State Water Project (SWP), operated by the California Department of Water Resources (DWR), are major interbasin water storage and delivery systems that divert water from the Sacramento River and San Joaquin River watersheds. These facilities also divert water from the southern portion of the Sacramento–San Joaquin River Delta (Delta) to areas located south and west of the Delta. Their operations store water during wet periods, divert water that is surplus to the Delta needs, and re-divert CVP and/or SWP water that has been stored in upstream reservoirs. The CVP and SWP operate pursuant to water right permits and licenses issued by the State Water Resources Control Board (SWRCB). These permits and licenses appropriate specific quantities of water for diversion to storage, releases from that storage later in the year, and/or direct diversion. As conditions of the water right permits and licenses, the CVP and SWP are required by SWRCB to meet specific water quality, quantity, and operational criteria. As a result, Reclamation and DWR closely coordinate CVP and SWP operations to meet these conditions.

The CVP was originally authorized by the Rivers and Harbors Act of 1935. It was reauthorized by the Rivers and Harbors Act of 1937 and again by the Central Valley Project Improvement Act (CVPIA) in 1992. The CVP is composed of nine divisions: Shasta and Trinity River Divisions, Sacramento River Division, American River Division, Delta Division, East Side Division, West San Joaquin Division, Friant Division, and the San Felipe Division. The CVP is composed of some 18 reservoirs with a combined storage capacity of more than 11 million acre-feet (MAF), 11 power plants, and more than 500 miles of major canals and aqueducts. These various facilities are generally operated as an integrated project, although they are authorized and categorized in divisions. Authorized project purposes include river regulation; flood control; navigation; provision of water for irrigation and domestic uses; fish and wildlife mitigation, protection, restoration, and enhancement; and power generation. However, not all facilities are operated to meet all of these purposes. As initially authorized, the primary CVP purpose was to provide water for irrigation throughout California's Central Valley. The CVPIA has amended CVP authorizations to include fish and wildlife mitigation, protection, and restoration; domestic uses; fish and wildlife enhancement; and power generation. The CVP's major storage facilities are Shasta Lake, Trinity Lake, Folsom Reservoir, and New Melones Reservoir. The upstream reservoirs release water for delivery to in-basin users, flows in Delta tributaries to meet Delta water quality objectives and outflow criteria, and for delivery of CVP water through the C.W. Jones Pumping Plant (Jones Pumping Plant) to storage in San Luis Reservoir (jointly operated by Reclamation and DWR) or delivery through the Delta Mendota Canal (DMC).

The Burns-Porter Act, approved by the California voters in November 1960 (Water Code Sec. 12930-12944), authorized issuance of bonds for construction of the SWP. The principal facilities of the SWP are Oroville Reservoir and related facilities, San Luis Dam and related facilities, Delta facilities, the California Aqueduct, and North and South Bay Aqueducts. The SWP stores and distributes water for agricultural and municipal and industrial (M&I) uses in the northern Central Valley, the San Francisco Bay area, the San Joaquin Valley, the Central Coast, and Southern California. Other project functions include flood control, water quality maintenance, power generation, recreation, and fish and wildlife enhancement. In general, water is released from storage facilities for delivery to in-basin users, into Delta tributaries to meet Delta water quality objectives and outflow criteria, and for delivery of SWP water through the Harvey O. Banks Pumping Plant (Banks Pumping Plant) to storage in San Luis Reservoir or delivery through the California Aqueduct.

3A.2 Coordinated Operation of the Central Valley Project and State Water Project

The CVP and SWP are operated in accordance with the Coordinated Operation Agreement adopted by the Federal and state government and water requirements issued by the SWRCB.

3A.2.1 Coordinated Operation Agreement

Reclamation and DWR have built water storage and water delivery facilities in the Central Valley in order to deliver water to affected water rights holders, and CVP and SWP (Project) contractors. Reclamation and DWR water rights are conditioned by SWRCB to protect the beneficial uses of water within the CVP and SWP and jointly for the protection of beneficial uses in the Sacramento Valley and the Sacramento–San Joaquin Delta Estuary. Reclamation and DWR coordinate and operate the CVP and SWP to meet water right and obligations upstream of the Delta, Delta water quality and flow objectives, joint water right requirements in the Delta, and CVP and SWP water right and obligations that depend upon diversions from the Delta.

The Coordinated Operation Agreement (COA), signed in 1986, defines the project facilities and their water supplies, coordinates operational procedures, identifies formulas for sharing joint responsibilities for meeting Delta standards (as the standards existed in SWRCB Water Right Decision 1485 [D-1485]) and other legal uses of water, identifies how unstored flow would be shared, establishes a framework for exchange of water and services between the CVP and SWP, and provides for periodic review of the agreement. DWR and Reclamation have operational arrangements to accommodate new facilities, water quality and flow objectives, the CVPIA, SWRCB criteria, and Federal Endangered Species Act (ESA), but the COA has not been formally modified to address the newer operating criteria under the CVPIA, SWRCB D-1641, 2008 USFWS BO, and 2009 NMFS BO.

3A.2.1.1 Obligations for In-Basin Uses

In-basin uses are defined in the COA as legal uses of water in the Sacramento Basin, including the water required under the SWRCB Decision 1485 (D-1485) Delta standards (D-1485 ordered the CVP and SWP to guarantee certain conditions for water quality protection for agricultural, M&I, and fish and wildlife uses). Each project is obligated to ensure water is available for these uses, but the degree of obligation is dependent on several factors and changes throughout the year, as described below.

Balanced water conditions are defined in the COA as periods when it is mutually agreed that releases from upstream reservoirs plus unregulated flows approximately equals 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. Reclamation's Central Valley Operations Office (CVOO) and DWR's SWP Operations Control Office (SWPOCO) jointly decide when balanced or excess water conditions exist.

During excess water conditions, sufficient water is available to meet all beneficial needs, and the CVP and SWP are not required to supplement the supply with additional releases. In excess water conditions, water accounting is not required and some of the excess water is available to CVP water contractors, SWP water contractors, and users located upstream of the Delta. However, during balanced water conditions, CVP and SWP share the responsibility in meeting in-basin uses.

When water must be withdrawn from reservoir storage to meet in-basin uses, 75 percent of the responsibility is borne by the CVP and 25 percent is borne by the SWP. When unstored water is available for export (i.e., Delta exports exceed storage withdrawals while balanced water conditions exist), the sum of CVP stored water, SWP stored water, and the unstored water for export is allocated 55/45 to the CVP and SWP, respectively. The percentages and ratios included in the COA were derived from negotiations between Reclamation and DWR for SWRCB D-1485 standards and operating conditions. Reclamation and DWR have continued to apply these ratios as new SWRCB standards are adopted.

3A.2.1.2 Accounting and Coordination of Operations

Reclamation and DWR coordinate on a daily basis to determine target Delta outflow for water quality, reservoir release levels necessary to meet in-basin demands, schedules for joint use of the San Luis Unit facilities, and for the use of each other's facilities for pumping and wheeling.

During balanced water conditions, daily water accounting is maintained for the CVP and SWP obligations. This accounting allows for flexibility in operations and avoids the necessity of daily changes in reservoir releases that originate several days' travel time from the Delta. It also means adjustments can be made "after the fact," using actual observed data rather than by prediction for the variables of reservoir inflow, storage withdrawals, and in-basin uses. This iterative process of observation and adjustment results in a continuous truing up of the running COA account.

The accounting language of the COA provides the mechanism for determining the responsibility of each project for Delta outflow influenced standards; however, real-time operations dictate actions. For example, conditions in the Delta can change rapidly. Weather conditions combined with tidal action can quickly affect Delta salinity conditions, and therefore, the Delta outflow required to maintain joint standards. If, in this circumstance, it is decided the reasonable course of action is to increase upstream reservoir releases, then the response may be to increase Folsom Reservoir releases first because the released water will reach the Delta before flows released from other CVP and SWP reservoirs. Lake Oroville water releases require about 3 days to reach the Delta, while water released from Shasta Lake requires 5 days to travel from Keswick Reservoir to the Delta. As water from the other reservoirs arrives in the Delta, Folsom Reservoir releases can be adjusted downward. Any imbalance in meeting each Project's initial shared obligation would be captured by the COA accounting.

Reservoir release changes are one means of adjusting to changing in-basin conditions. Increasing or decreasing project exports can also immediately achieve changes to Delta outflow. As with changes in reservoir releases, imbalances in meeting each project's initial shared obligations are captured by the COA accounting.

During periods of balanced water conditions, when real-time operations dictate project actions, an accounting procedure tracks the initial sharing water obligations of the CVP and SWP. The CVP and SWP produce daily and accumulated accounting balances. The account represents the imbalance resulting from actual coordinated operations compared to the initial COA sharing of obligations and supply. The project that is "owed" water (i.e., either CVP or SWP provided more or exported less than its COA-defined share) may request the other Project adjust its operations to reduce or eliminate the accumulated account within a reasonable time.

The duration of balanced water conditions varies from year to year. Some very wet years have had no periods of balanced conditions, while very dry years have had long continuous periods of balanced conditions, and still other years may have had several periods of balanced conditions interspersed with excess water conditions. Account balances continue from one balanced water condition through the excess water condition and into the next balanced water condition. When the Project that is owed water enters into flood control operations, Shasta Lake and Folsom Reservoir for the CVP and Lake Oroville for the SWP, the accounting is zeroed out for that Project.

3A.2.1.3 Changes in Coordinated Operation Since 1986

Implementation of the COA principles has continuously evolved since 1986 as changes have occurred to CVP and SWP facilities, to Project operations criteria, and to the overall physical and regulatory environment in which the coordination of CVP and SWP operations takes place. Since 1986, new facilities have been incorporated into the operations that were not part of the original COA. New water quality and flow standards (SWRCB Water Right Decision 1641 [D-1641]) have been adopted by SWRCB; the CVPIA has changed how the CVP is operated; and finally, ESA responsibilities have affected both the CVP and SWP operations. The following describes the significant changes that have occurred since 1986. Included after each item is an explanation of how it relates to the COA and its general effect on the accomplishments of the Projects.

3A.2.1.3.1 Sacramento River Temperature Control Operations

Water temperature control operations have changed the pattern of storage and withdrawal of storage at Shasta Lake, Trinity Lake, and Whiskeytown Reservoir, for the purpose of improving temperature control and managing coldwater pool resources in the facilities. Water temperature operations have also constrained rates of flow and changes in rates of flow below Keswick Dam, in keeping with water temperature requirements. Such constraints have reduced the CVP's ability to respond efficiently to changes in Delta export or outflow requirements. Periodically, temperature requirements have caused the timing of the CVP releases to be significantly mismatched with Delta export capability, resulting in loss of water supply. The installation of a Shasta Lake temperature control device has significantly improved Reclamation's ability to match reservoir releases and Delta needs.

3A.2.1.3.2 Bay-Delta Accord, and Subsequent SWRCB Implementation of D-1641

The 1994 Bay-Delta Accord committed the CVP and SWP to a set of Delta habitat-protective objectives that were eventually incorporated into the 1995 Bay-Delta Water Quality Control Plan (WQCP), and later, along with the temporary Vernalis Adaptive Management Plan (VAMP) (since expired), were included by SWRCB D-1641 amending the water rights of the Projects. The actions taken by the CVP and SWP in implementing SWRCB D-1641 significantly reduced the export water supply of both Projects.

As described previously, Project operators must coordinate the day-to-day operations of the CVP and SWP to comply with the Projects' water right permits. The 1986 COA sharing formula has been used by Project operators for SWRCB D-1641 Delta outflow and salinity-based standards. SWRCB D-1641 contains significant new "export limitation" criteria such as the export to inflow (E/I) ratios. The 1986 COA framework neither contemplated nor addressed the application of such criteria to CVP and SWP permits. When the E/I restrictions control Project operations, Project operators attempt to utilize "equity principles" to determine how to comply with SWRCB D-1641 standards. In most cases, the attempt is made to even out the rate of export over the restricted period. In some cases, a seasonal time shift of the SWP exports can help facilitate an equitable sharing of responsibilities. Until the COA is updated to reflect SWRCB D-1641 conditions, Project operators must continually work on a case-by-case basis in order to meet the Projects' combined water right requirements.

3A.2.1.3.3 North Bay Aqueduct

The North Bay Aqueduct (NBA) is a SWP feature that can convey up to about 175 cubic feet per second (cfs) diverted from the SWP's Barker Slough Pumping Plant. NBA diversions are conveyed to SWP water contractors in Napa and Solano Counties. The diversion is currently treated as an in-basin demand shared by both Projects.

3A.2.1.3.4 Freeport Regional Water Project

The Freeport Regional Water Project is a new facility that diverts up to a maximum of 286 cfs from the Sacramento River near Freeport for use in Sacramento County and by East Bay Municipal Utility District (EBMUD). EBMUD diverts water pursuant to its amended contract with Reclamation. The County diverts under their water rights and a CVP water service contract supply. This facility was not in the 1986 COA, and the diversions result in an increase of in-basin demands. The diversion is currently treated as an in-basin demand shared by both Projects.

3A.2.1.3.5 Loss of 195,000 Acre-Feet of D-1485 Condition 3 Replacement Pumping

The 1986 COA affirmed the SWP's commitment to provide replacement capacity at Banks Pumping Plant to the CVP at times when it would not reduce SWP yield, to make up for May and June pumping reductions at Jones Pumping Plant as imposed by striped bass protections under SWRCB D-1485 in 1978. In the evolution of COA operations since 1986, SWRCB D-1485 was superseded by SWRCB D-1641, and SWP water demand growth and other pumping constraints have reduced the available surplus capacity at Banks Pumping Plant. The CVP has not received replacement pumping since 1993. Since then there have been (and in the current operations environment there will continue to be) many years in which the CVP would be limited by insufficient Delta export capacity to convey its water supply. The loss of up to 195,000 acre-feet of replacement pumping capacity has diminished the water delivery anticipated by the CVP water users that receive water diverted from the Delta under the 1986 COA framework. The diminished water delivered results in an allocation, or charge, to CVPIA (b)(2) water.

3A.2.2 State Water Resources Control Board Water Rights

3A.2.2.1 Decision 1641

SWRCB adopted the 1995 WQCP on May 22, 1995, which was implemented, in part, through the SWRCB D-1641. SWRCB D-1641 (adopted on December 29, 1999 and revised on March 15, 2000) amends certain terms and conditions of the SWP and CVP water rights to impose flow and water quality objectives to assure protection of beneficial uses in the Delta and Suisun Marsh. SWRCB also grants conditional changes to points of diversion for each project with SWRCB D-1641.

The requirements in SWRCB D-1641 address the standards for fish and wildlife protection, M&I water quality, agricultural water quality, and Suisun Marsh salinity. These objectives include specific outflow requirements throughout the year, specific export limits 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 vary throughout the year and by the wetness of the year.

SWRCB D-1641 also authorizes the SWP and CVP to jointly use each other's points of diversion in the southern Delta, with conditional limitations and required response coordination plans. This is described below in more detail. SWRCB D-1641 modified the Vernalis salinity standard under SWRCB Decision 1422 (D-1422) to the corresponding Vernalis salinity objective in the 1995 WQCP.

3A.2.2.2 Joint Points of Diversion

SWRCB D-1641 granted Reclamation and DWR the ability to divert water at either Project's south Delta intakes under certain conditions. The SWRCB conditioned the use of Joint Point of Diversion (JPOD) capabilities based on staged implementation and conditional requirements for each stage of implementation. The stages of JPOD in SWRCB D-1641 are:

- Stage 1—for water service to Cross Valley contractors, San Joaquin Valley National Cemetery and Musco Family Olive Company, 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 in order to implement JPOD.

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

Any JPOD diversion that causes the Delta to change from excess to balanced conditions is junior to Contra Costa Water District's (CCWD) water right permits for the Los Vaqueros Project. The SWRCB D-1641 also required that JPOD diversions not result in an upstream shift in the X2 location (where 2 parts per thousand salinity isopleth measured at 1 meter from the channel bottom occurs) west of certain compliance locations.

Stage 2 has an additional requirement to complete an operations plan that would protect fish and wildlife and other legal users of water. This is commonly known as the Fisheries Response Plan. A Fisheries Response Plan was approved by SWRCB in February 2007.

Stage 3 has an additional requirement to protect water levels in the southern Delta under the operational conditions of Phase II of the South Delta Improvements Program, along with an updated companion Fisheries Response Plan.

Reclamation and DWR intend to apply all response plan criteria consistently for JPOD uses as well as water transfer uses.

In general, JPOD capabilities are used to accomplish four basic CVP and SWP objectives:

- When wintertime excess pumping capacity becomes available during Delta excess conditions and total CVP and SWP San Luis storage is not projected to fill before the spring pulse flow period, the Project with the deficit in San Luis storage may elect to pursue the use of JPOD capabilities.
- When summertime pumping capacity is available at Banks Pumping Plant and CVP reservoir conditions can support additional releases, the CVP may elect to use JPOD capabilities to enhance annual CVP south of Delta water supplies.
- When summertime pumping capacity is available at Banks or Jones Pumping Plant to facilitate water transfers, JPOD may be used to further facilitate water transfers.
- During certain coordinated CVP and SWP operation scenarios for fishery entrainment management, JPOD may be used to shift CVP and SWP exports to the facility with the least fishery entrainment impact while minimizing export at the facility with the most fishery entrainment impact.

3A.2.2.3 Revisions to the SWRCB Bay-Delta Water Quality Control Plan

SWRCB undertook a proceeding under its water quality authority to amend the WQCP adopted in 1978 and amended in 1991 and in 1995. The SWRCB conducted a series of workshops in 2004 and 2005 to receive information on specific topics addressed in the WQCP.

The SWRCB adopted a revised WQCP 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 WQCP. A number of changes were made simply for readability. Consistency changes were also made to assure that sections of the WQCP reflected the current physical condition or current regulation.

The SWRCB "is in the process of developing and implementing updates to the WQCP and flow objectives for priority tributaries to the Delta to protect beneficial uses in the Bay-Delta watershed. Phase 1 of this work involves updating San Joaquin River flow and southern Delta water quality requirements included in the WQCP. Phase 2 involves other comprehensive changes to the WQCP to protect beneficial uses not addressed in Phase 1. Phase 3 involves changes to water rights and other measures to implement changes to the WQCP from Phases 1 and 2. Phase 4 involves developing and implementing flow objectives for priority Delta tributaries outside of the WQCP updates" (State Water Resources Control Board 2014).

3A.2.3 2008 U.S. Fish and Wildlife Service and 2009 National Marine Fisheries Service Biological Opinions on the Coordinated Operation of CVP and SWP

The most recent BOs regarding the long-term coordinated operation of the CVP and SWP were issued by the USFWS and NMFS in 2008 and 2009, respectively. Each BO included a Reasonable and Prudent Alternative (RPA). In December 2008, USFWS issued a BO for Delta Smelt and their critical habitat, and Reclamation provisionally accepted and implemented the RPA. In June 2009, NMFS issued a new BO 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 implemented the RPA. Under the 2008 USFWS and 2009 NMFS BOs, CVP and SWP operations include the previous operational requirements of SWRCB D-1641 and additional operational requirements, as described below.

3A.3 Operations Real-Time Decision Making

The goals for real-time decision making to assist fishery management are to minimize adverse effects for listed species while meeting permit requirements and contractual obligations for water deliveries.

Real-time decision making is a process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. High uncertainty exists regarding real time conditions that can change management decisions on methods to balance operations to meet beneficial uses in 2030.

Sources of uncertainty include the following.

- Hydrologic conditions
- Ocean conditions
- Listed species (presence, distribution, habitat, and other factors)
- Ecological conditions

3A.3.1 Process for Real-Time Decision Making

Decisions regarding CVP and SWP operations to avoid and minimize adverse effects on listed species must consider factors that include public health, safety, and water supply reliability. To facilitate such decisions, Reclamation and DWR (Project Agencies) and the fishery agencies (consisting of USFWS, NMFS, and the California Department of Fish and Wildlife [CDFW]) have developed and refined a set of processes for various fish species to collect data, disseminate information, develop recommendations, make decisions, and provide transparency. This process consists of three types of groups that meet on a recurring basis (Table 3A.1):

- The management team is made up of management staff from Reclamation, DWR, and the fishery agencies. SWRCB participates in management team meetings.
- Information teams are teams whose role is to disseminate and coordinate information among agencies and stakeholders.
- Fisheries and operations technical teams are made up of technical staff from state and Federal agencies.

These teams review the most up-to-date data and information on fish status and Delta conditions, and develop recommendations that fishery agencies' management can use in identifying actions to protect listed species.

The process to identify actions to protect listed species varies to some degree among species but abides by the following general outline. A Fisheries or Operations Technical Team compiles and assesses current information regarding species, such as stages of reproductive development, geographic distribution, relative abundance, and physical habitat conditions. It then provides a recommendation to the agency with statutory obligation to enforce protection of the species in question. The agency's staff and management reviews the recommendation and uses it as a basis for developing, in cooperation with Reclamation and DWR, a modification of water operations that would minimize adverse effects on listed species by the Projects. If the Project Agencies do not agree with the action, then the fishery agency(ies) would advise the Project

Agencies that the water management activity considered may cause harm to the listed species beyond that contemplated in the existing BO. Certain actions may require input from the SWRCB to assess impacts to the beneficial uses of the project water because actions can also affect the Projects' ability to comply with state water rights. In the event it is not possible or appropriate to refine the action, given the available resources, the Project Agencies would consult with the fishery agency(ies). The outcomes of protective actions that are implemented are monitored and documented, and this information informs future recommended actions.

Table 3A.1 Real-Time Decision Making Groups

Team Name	Abbreviation	Composition
Water Operations Management Team	WOMT	Reclamation, DWR, USFWS, NMFS, and CDFW. SWRCB participates
CALFED Bay-Delta Program (CALFED) Ops Group	CALFED Ops Group	Reclamation, DWR (Project Agencies), fishery agencies, SWRCB staff, and the USEPA
Data Assessment Team	DAT	Technical staff members from the Project Agencies and fishery agencies; stakeholders
Operations and Fishery Forum	OFF	Contact persons for their respective agencies or interest groups; works in concert with CALFED Ops Group
B2 Interagency Team	(b)(2)IT	Technical staff members from the Project Agencies
Sacramento River Temperature Task Group	SRTTG	Multiagency group
Smelt Working Group	SWG	USFWS, CDFW, DWR, USEPA, and Reclamation
Delta Condition Team	DCT	Scientists and engineers from the state and federal agencies, water contractors, and environmental groups
Delta Operations Salmonid and Sturgeon	DOSS	Reclamation, DWR, CDFW, USFWS, SWRCB, USGS, USEPA, and NMFS
American River Group	ARG	Reclamation, USFWS, NMFS, CDFW, and the Water Forum
Delta Cross Channel Project Work Team	DCC Project Work Team	Multiagency group
Stanislaus Operations Team	OT	To be developed as part of the New Melones revised plan of operations

3A.3.1.1 Salmon Decision Process

The Salmon Decision Process is used by the fishery agencies and Project operators to facilitate the often complex coordination issues surrounding Delta Cross Channel (DCC) gate operations and the purposes of fishery protection closures, Delta water quality, and/or export reductions. Inputs such as fish life stage and size development, current hydrologic events, fish indicators (such as the Knight's Landing Catch Index and Sacramento Catch Index), and salvage at the export facilities, as well as current and projected Delta water quality conditions, are used to determine potential DCC closures and/or export reductions. The Salmon Decision Process includes "Indicators of Sensitive Periods for Salmon," such as hydrologic changes, detection of spring-run salmon or spring-run salmon surrogates at monitoring sites or the salvage facilities, and turbidity increases at monitoring sites, which trigger the Salmon Decision Process. The coordination process has worked well during the recent fall and winter DCC operations and is expected to be used in the present or modified form in the future.

3A.3.2 Groups Involved in Real-Time Decision Making and Information Sharing

3A.3.2.1 Management Team

The Water Operations Management Team (WOMT) is composed of representatives from Reclamation, DWR, USFWS, NMFS, and CDFW. SWRCB participates in discussions. This management-level team was established to facilitate timely decision-support and decision making at the appropriate level. The WOMT first met in 1999, continues to meet to make management decisions. Although the goal of WOMT is to achieve consensus on decisions, the participating agencies retain their authorized roles and responsibilities.

3A.3.2.2 Information Teams

3A.3.2.2.1 CALFED Ops and Subgroups

The CALFED Bay-Delta Program (CALFED) Ops Group consists of the Project Agencies, the fishery agencies, SWRCB staff, U.S. Environmental Protection Agency (USEPA), and stakeholders. The CALFED Ops Group generally meets eight times a year in a public setting so that the agencies can inform each other and stakeholders about current operations of the CVP and SWP, implementation of the CVPIA and state and federal endangered species acts, and additional actions to contribute to the conservation and protection of state- and federally listed species. The CALFED Ops Group held its first public meeting in January 1995, and during the next six years the group developed and refined its process. The CALFED Ops Group has been recognized within SWRCB D-1641, and elsewhere, as one forum for coordination on decisions to exercise certain flexibility that has been incorporated into the Delta standards for protection of beneficial uses (e.g., E/I ratios, and some DCC closures). Several teams were established through the CALFED Ops Group process. These teams are described below.

3A.3.2.2.2 Data Assessment Team

The Data Assessment Team (DAT) consists of technical staff members from the Project Agencies and fishery agencies as well as stakeholders. The DAT meets frequently during the fall, winter, and spring. The purpose of the meetings is to coordinate and disseminate information and data among agencies and stakeholders that is related to water Project operations, hydrology, and fish surveys in the Delta.

3A.3.2.2.3 Operations and Fishery Forum

The Operations and Fishery Forum (OFF) was established as an ad-hoc stakeholder-driven process to disseminate information regarding recommendations and decisions about the operations of the CVP and SWP. OFF members are considered the contact persons for their respective agencies or interest groups when information regarding take of listed species, or other factors or urgent issues need to be addressed by the CALFED Ops Group. Alternatively, the CALFED Ops Group may direct the OFF to develop recommendations on operational responses for issues of concern raised by member agencies.

3A.3.2.3 B2 Interagency Team

The B2 Interagency Team [(b)(2)IT] was established in 1999 in accordance with CVPIA and consists of technical staff members from the Project Agencies. CALFED recognized this group to facilitate coordinated operations. The (b)(2)IT meets weekly to discuss implementation of Section 3406 (b)(2) of the CVPIA, which defines the dedication of CVP water supply for environmental purposes. It communicates with WOMT to ensure coordination with the other operational programs or resource-related aspects of Project operations, including flow and temperature issues.

3A.3.3 Operations and Fisheries Technical Teams

Several fisheries-specific teams have been established to provide guidance and recommendations on current operations (flow and temperature regimes), as well as resource management issues. These teams include the following.

3A.3.3.1 The Sacramento River Temperature Task Group

The Sacramento River Temperature Task Group (SRTTG) is a multiagency group formed pursuant to SWRCB Water Rights Orders 90-5 and 91-1, to assist with improving and stabilizing the Chinook Salmon population in the Sacramento River. Annually, Reclamation develops temperature operation plans for the Shasta and Trinity divisions of the CVP. These plans consider impacts on winter-run and other races of Chinook Salmon and associated Project operations. The SRTTG meets initially in the spring to discuss biological, hydrologic, and operational information, objectives, and alternative operations plans for temperature control. Once the SRTTG has recommended an operation plan for temperature control, Reclamation then submits a report to SWRCB, generally on or before June 1 each year.

After implementation of the operation plan, the SRTTG may perform additional studies. It holds meetings as needed, typically monthly through the summer and into fall, to develop revisions based on updated biological data, reservoir temperature profiles, and operations data. Updated plans may be needed for summer operations to protect winter-run, or in fall for the fall-run spawning season. If there are any changes in the plan, Reclamation submits a supplemental report to SWRCB.

3A.3.3.2 Smelt Working Group

The Smelt Working Group (SWG) consists of representatives from USFWS, CDFW, DWR, USEPA, and Reclamation. USFWS chairs the group, and a member is assigned by each agency. The SWG evaluates biological and technical issues regarding Delta Smelt and develops recommendations for consideration by USFWS. Since longfin smelt became a state candidate species in 2008, the SWG has also developed recommendations for CDFW to minimize adverse effects on longfin smelt.

The SWG compile and interpret the latest near real-time information regarding state- and federally listed smelt, such as stages of development, distribution, and salvage. After evaluating available information, if the SWG members agree that a protection action is warranted, the SWG submit its recommendations in writing to USFWS and CDFW.

The SWG may meet at any time at the request of USFWS, but generally meets weekly during the months of January through June, when smelt salvage at the CVP and SWP has occurred historically.

3A.3.3.3 Delta Condition Team

The existing SWG and WOMT advise USFWS on smelt conservation needs and water operations. In addition, a Delta Condition Team (DCT), consisting of scientists and engineers from the state and federal agencies, water contractors, and environmental groups, meet weekly to review the real time operations and Delta conditions, including data from new turbidity monitoring stations and new analytical tools such as the Delta Smelt behavior model. The members of the DCT provide their individual information to the SWG and the Delta Operations Salmonid and Sturgeon (DOSS) workgroup. SWG meet later on the day the DCT meets to assess risks to Delta Smelt based upon Delta conditions and the other factors set forth above. The SWG and individual members of the DCT may provide, in accordance with a process provided by the WOMT, their information to the WOMT for its consideration in developing a recommendation to the Project Agencies for actions to protect Delta Smelt and other listed fish. The WOMT supply information for Project Agencies to consider, including impacts on other species and on water supply.

3A.3.3.4 Delta Operations Salmonid and Sturgeon Workgroup

The DOSS workgroup is a technical team with relevant expertise from Reclamation, DWR, CDFW, USFWS, SWRCB, U.S. Geological Survey (USGS), USEPA, and NMFS that provides advice to WOMT and to NMFS on issues related to fisheries and water resources in the Delta and recommendations on measures to reduce adverse effects of Delta operations of the CVP and SWP to salmonids and Green Sturgeon. The purpose of DOSS is to provide recommendations for real-time management of operations to WOMT and NMFS; annually review Project operations in the Delta and the collected data from the different ongoing monitoring programs; and coordinate with the SWG to maximize benefits to all listed species.

3A.3.3.5 American River Group

In 1996, Reclamation established a working group for the Lower American River, known as the American River Group (ARG). Although open to the public, the ARG meetings generally include representatives from several agencies and organizations with ongoing concerns and interests regarding management of the Lower American River. The formal members of the group are Reclamation, USFWS, NMFS, CDFW, and the Water Forum.

The ARG convenes monthly or more frequently if needed, with the purpose of providing fishery updates and reports for Reclamation to help manage operations at Folsom Dam and Reservoir for the protection of fishery resources in the Lower American River, and with consideration of its other intended purposes (e.g., water and power supply).

3A.3.3.6 Delta Cross Channel Project Work Team

The DCC Project Work Team is a multiagency group. Its purpose is to determine and evaluate the effects of DCC gate operations on Delta hydrodynamics, water quality, and fish migration.

3A.4 Central Valley Project

3A.4.1 Project Management Objectives

Facilities are operated and maintained by local Reclamation area offices, with operations overseen by the CVOO at the Joint Operations Center in Sacramento, California. The CVOO is responsible for recommending CVP operating policy, developing annual operating plans, coordinating CVP operations with the SWP and other entities, establishing CVP-wide standards and procedures, and making day-to-day operating decisions.

3A.4.1.1 Central Valley Project Improvement Act

Public Law 102-575 (Reclamation Projects Authorization and Adjustment Act of 1992) was passed on October 30, 1992. Included in the law was Title 34, the Central Valley Project Improvement Act. The CVPIA amended previous authorizations of the CVP 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 as having an equal priority with power generation. Among the changes mandated by the CVPIA are:

- Dedicating 800 thousand acre-feet (TAF) annually to fish, wildlife, and habitat restoration
- Authorizing water transfers outside the CVP service area
- Facilitating water transfers
- Implementing an anadromous fish restoration program
- Creating a restoration fund financed by water and power users
- Providing for the Shasta Temperature Control Device
- Implementing fish passage measures at Red Bluff Pumping Plant
- Calling for planning to increase the CVP yield
- Mandating firm water supplies for Central Valley wildlife refuges
- Improving the Tracy Fish Collection Facility (TFCF)
- Meeting Federal trust responsibility to protect fishery resources (Trinity River)

The CVPIA is being implemented as authorized. The Final Programmatic Environmental Impact Statement (PEIS) for the CVPIA analyzed projected conditions in 2022, 30 years from the CVPIA's adoption in 1992. The Final PEIS was released in October 1999 and the CVPIA Record of Decision (ROD) was signed on January 9, 2001. The CVPIA BOs were issued on November 21, 2000.

3A.4.1.1.1 CVPIA Section 3406 (b)(2)

On May 9, 2003, the DOI issued its Decision on Implementation of Section 3406 (b)(2) (Decision) of the CVPIA. Dedication of CVPIA (b)(2) water occurs when Reclamation takes a fish, wildlife or habitat restoration action based on recommendations of USFWS (and in consultation with NMFS and CDFW), pursuant to Section 3406 (b)(2). Dedication and management of CVPIA (b)(2) water may also assist in meeting SWRCB WQCP fishery objectives and helps meet the needs of fish listed under the ESA as threatened or endangered since the enactment of the CVPIA.

The Decision describes the means by which the amount of dedicated CVPIA (b)(2) water is determined. Planning and accounting for CVPIA (b)(2) actions are done cooperatively and occur primarily through weekly meetings of the (b)(2)IT. The (b)(2)IT formulates recommendations for implementing upstream and Delta actions with CVP delivery capability. Actions usually take one of two forms—instream flow augmentation below CVP reservoirs or CVP Jones Pumping Plant pumping reductions in the Delta.

3A.4.2 Water Service Contracts, Allocations, and Deliveries

3A.4.2.1 Water Needs Assessment

Water needs assessments have been performed for each CVP water contractor eligible to participate in the CVP long-term contract renewal process. Water needs assessments confirm a contractor's past beneficial use and determine future CVP water supplies needed to meet the contractor's anticipated future demands. The assessments are based on a common methodology used to determine the amount of CVP water needed to balance a contractor's water demands with available surface and groundwater supplies.

3A.4.2.2 Water Allocation—CVP

In most years, the combination of carryover storage and runoff into CVP reservoirs and the Central Valley is not sufficient to provide the water to meet all CVP contractors' contractual demands. Since 1992, increasing constraints placed on operations by legislative and ESA requirements have removed significant operational flexibility to deliver water to all CVP contractors located both to the north and south of the Delta.

The water allocation process for the CVP begins in the fall when preliminary assessments are made of the next year's water supply possibilities, given current storage conditions combined with a range of hydrologic conditions. These preliminary assessments may be refined as the water year progresses. Beginning February 1, forecasts of water year runoff are prepared using precipitation to date, snow water content accumulation, and runoff to date. All of CVP's Sacramento River Settlement water rights contracts and San Joaquin River Exchange contracts require that contractors be informed no later than February 15 of any possible deficiency in their supplies. In recent years, February 20 has been the target date for the first announcement of all CVP contractors' forecasted water allocations for the upcoming contract year. Forecasts of runoff and operations plans are updated at least monthly between February and May.

Reclamation uses the 90 percent probability of exceedance forecast as the basis of water allocations. Furthermore, NMFS reviews the operations plans devised to support the initial water allocation, and any subsequent updates to them, for sufficiency with respect to the criteria for Sacramento River temperature control.

3A.4.2.3 CVP Municipal and Industrial Water Shortage Operational Assumptions

Reclamation is in the process of revising the current 2001 draft M&I water shortage policy. A draft EIS was released for public review in 2014. A description of 2001 draft M&I water shortage policy is provided below.

3A.4.2.3.1 Draft 2001 Municipal and Industrial Water Shortage Policy

The CVP has 253 water supply contracts (including water service contracts and Sacramento River Settlement Contracts). These water service contracts have had varying water shortage provisions (e.g., in some contracts, M&I and agricultural users have shared shortages equally; in most of the larger M&I contracts, agricultural water has been shorted 25 percent of its contract water before M&I water was shorted, after which both types of water contractors experience shortages with agricultural users experiencing greater shortages than M&I users, as described below).

The M&I minimum shortage allocation described above does not apply to contracts for the (1) Friant Division, (2) New Melones interim supply, (3) Hidden and Buchanan Units, (4) Cross Valley contractors, (5) Wildlife refuges, (6) San Joaquin River Exchange contractors, and (7) Sacramento River Settlement contractors. These contracts have separate shortage-related contractual provisions.

There is a minimum shortage allocation for M&I water supplies of 75 percent of a contractor's historical use (i.e., the last 3 years of water deliveries unconstrained by the availability of CVP water). Historical use can be adjusted for growth, extraordinary water conservation measures, and use of non-CVP water as those terms are defined in the proposed policy. Before the M&I water allocation is reduced, the irrigation water allocation would be reduced below 75 percent of contract water.

When the allocation of irrigation water is reduced below 25 percent of contract water, Reclamation would reassess the availability of CVP water and CVP water demand; however, due to limited water supplies during these times, M&I water allocation may be reduced below 75 percent of adjusted historical use during extraordinary and rare times such as prolonged and severe drought. Under these extraordinary conditions, allocation percentages for both South of Delta and North of Delta irrigation contractors are reduced below 25 percent to zero while the M&I contractors are reduced below 75 percent to 50 percent by the same increment, as described below.

Reclamation would attempt to deliver CVP water to all M&I contractors at not less than a public health and safety level if CVP water is available, if an emergency situation exists, but not exceeding 75 percent of contract total (and taking into consideration water supplies available to the M&I contractors from other sources). This is in recognition, however, that the M&I allocation may, nevertheless, fall to 50 percent as the irrigation allocation drops below 25 percent and approaches zero due to limited CVP supplies.

- Allocation Assumptions for Below Normal, Above Normal, and Wet Years:
  - Agricultural 100 percent to 75 percent — M&I is at 100 percent
  - Agricultural 70 percent — M&I 95 percent
  - Agricultural 65 percent — M&I 90 percent
  - Agricultural 60 percent — M&I 85 percent
  - Agricultural 55 percent — M&I 80 percent
  - Agricultural 50 to 25 percent — M&I 75 percent

- Allocation Assumptions for Dry and Critical Years:
  - Agricultural 20 percent M&I 70 percent
  - Agricultural 15 percent M&I 65 percent
  - Agricultural 10 percent M&I 60 percent
  - Agricultural 5 percent M&I 55 percent
  - Agricultural 0 percent M&I 50 percent

3A.4.3 Project Facilities

3A.4.3.1 Trinity River Division Operations

The Trinity River Division, completed in 1964, includes facilities to store and regulate water in the Trinity River, as well as facilities to divert water to the Sacramento River Basin. The Trinity River Division includes the Trinity River and Dam, Lewiston Dam, Whiskeytown Reservoir and Dam, Clear Creek, and Spring Creek and Debris Dam. Trinity Dam is located on the Trinity River and regulates the 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.

Water is diverted from the Trinity River at Lewiston Dam via the Clear Creek Tunnel and passes through the Judge Francis Carr Powerhouse as it is discharged into Whiskeytown Lake on Clear Creek. From Whiskeytown Lake, water is released through the Spring Creek Power Conduit to the Spring Creek Power Plant and into Keswick Reservoir. All of the water diverted from the Trinity River, plus a portion of Clear Creek flows, is diverted through the Spring Creek Power Conduit into Keswick Reservoir.

Spring Creek also flows into the Sacramento River and enters at Keswick Reservoir. Flows on Spring Creek are partially regulated by the Spring Creek Debris Dam. Historically (1964–1992), an average annual quantity of 1,269 TAF of water has been diverted from Whiskeytown Lake to Keswick Reservoir. This annual quantity is approximately 17 percent of the flow measured in the Sacramento River at Keswick.

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).

3A.4.3.1.1 Safety of Dams at Trinity Reservoir

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

The Safety of Dams release criteria specify that Carr power plant capacity be used as a first preference destination for Safety of Dams releases made at Trinity Dam. Trinity River releases are made as a second preference destination. During significant Northern California high-water flood events, the Sacramento River water stages are also often at concern levels. Under such high-water conditions, the water that would otherwise move through the Carr power plant is routed to the Trinity River. Total river releases are capped at 11,000 cfs from Lewiston Dam (under Safety of Dams criteria) due to local high water concerns in the floodplain and local bridge flow capacities. The Safety of Dams criteria provide seasonal storage targets and recommended releases November 1 to March 31. During the May 2006 event, the river flows were over 10,000 cfs for several days as part of the fishery restoration flows.

3A.4.3.1.2 Fish and Wildlife Requirements on Trinity River

Based on the Trinity River Main-stem Fishery Restoration ROD, dated December 19, 2000, 368.6 TAF to 815 TAF is allocated annually for Trinity River flows, depending on water year type. This amount is scheduled in coordination with USFWS to best meet habitat, temperature, and sediment transport objectives in the Trinity Basin.

Temperature objectives for the Trinity River are set forth in SWRCB Water Rights Order 90-5, as summarized in Table 3A.2. These objectives vary by reach and by season. Between Lewiston Dam and Douglas City Bridge, the daily average temperature should not exceed 60 degrees Fahrenheit (°F) from July 1 to September 14, and 56°F from September 15 to September 30. From October 1 to December 31, the daily average temperature should not exceed 56°F between Lewiston Dam and the confluence of the North Fork Trinity River. Reclamation consults with USFWS in establishing a schedule of releases from Lewiston Dam that can best achieve these objectives.

For the purpose of determining the Trinity Basin water year type, forecasts using the 50 percent exceedance as of April 1 are used. There are no make-up or increases for flows forgone if the water year type changes up or down from an earlier 50 percent forecast. In the modeling, actual historic Trinity inflows were used rather than a forecast. There is a temperature curtain in Lewiston Reservoir that provides for temperature management for the diversions to Clear Creek Tunnel.

Table 3A.2 Water Temperature Objectives for the Trinity River during the Summer, Fall, and Winter as Established by the California Regional Water Quality Control Board North Coast Region

Date	Temperature Objective (°F)	
	Douglas City (RM 93.8)	North Fork Trinity River (RM 72.4)
July 1 through September 14	60	–
September 15 through September 30	56	–
October 1 through December 31	–	56

3A.4.3.1.3 Transbasin Diversions

Diversion of Trinity water to the Sacramento Basin provides water supply and major hydroelectric power generation for the CVP and plays a key role in water temperature control in the Trinity River and upper Sacramento River. The amounts of the Trinity exports are determined by subtracting Trinity River scheduled flow and targeted carryover storage from the forecasted Trinity water supply.

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 Lake) to help conserve 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 occurs in Whiskeytown Lake due to the long residence time of transbasin exports in the lake.

To minimize the thermal degradation effects, transbasin export patterns are typically scheduled by an operator to provide an approximate 120 TAF volume to occur in late spring to create a thermal connection to the Spring Creek Powerhouse before larger transbasin volumes are scheduled to occur during the hot summer months. Typically, the water flowing from the Trinity Basin through Whiskeytown Lake must be sustained at fairly high rates to avoid warming and to function most efficiently for temperature control. The time period for which effective temperature control releases can be made from Whiskeytown Lake may be compressed when the total volume of Trinity water available for export is limited.

Export volumes from Trinity are made in coordination with the operation of Shasta Lake. Other important considerations affecting the timing of Trinity exports are based on the utility of power generation and allowances for normal maintenance of the diversion works and generation facilities.

Trinity Lake historically reached its greatest storage level at the end of May. With the present pattern of prescribed Trinity releases, maximum storage may occur by the end of April or in early May.

Reclamation maintains at least 600 TAF in Trinity Reservoir, except during the 10 to 15 percent of the years when Shasta Lake is also drawn down. Reclamation addresses end-of-water-year carryover on a case-by-case basis in dry and critically dry water year types with USFWS and NMFS through the WOMT and (b)(2)IT processes.

3A.4.3.1.4 Whiskeytown Reservoir Operations

Whiskeytown Reservoir is normally operated to (1) regulate inflows for power generation and recreation; (2) support upper Sacramento River temperature objectives; and (3) provide for releases to Clear Creek consistent with the CVPIA Anadromous Fish Restoration Program (AFRP) objectives. Although it stores up to 241 TAF, this storage is not normally used as a source of water supply. Two temperature curtains in Whiskeytown Reservoir were installed in 1993 to pass cold water through the reservoir and to help regulate the temperature range requirements of salmon eggs and sac-fry. The curtains were made of reinforced rubber sheets that form a continuous barrier under the water. The Oak Bottom Temperature Control Curtain or OBTCC is located in the upstream portion of the reservoir and causes inflowing cold water to sink to the bottom. The OBTCC was originally 600 feet long and reached a depth of 40 feet. However, the OBTCC was damaged and cannot be fully deployed. The curtain is estimated to be repaired by 2030 under the No Action Alternative, depending on available funding and subject to environmental compliance requirements. The Spring Creek curtain is located near Whiskeytown Dam to maximize cold water flows through the intakes into the Spring Creek Power Conduit. It was damaged significantly, and was replaced in 2011.

Implementation of 2009 National Marine Fisheries Service Biological Opinion

In accordance with the 2009 NMFS BO RPA Action I.1.5, Reclamation is required to manage Whiskeytown Lake releases to meet daily water temperatures in Clear Creek at Igo of:

- 60° F from June 1 through September 15
- 56° F from September 15 through October 31

3A.4.3.1.5 Historic Spillway Flows below Whiskeytown Lake

Whiskeytown Lake is annually drawn down by approximately 35 TAF of storage space during November through April to regulate flows for power generation. Heavy rainfall events occasionally result in spillway discharges to Clear Creek, as shown in Table 3A.3 below.

Table 3A.3 Days of Spilling below Whiskeytown and 40-30-30 Index from Water Year 1978 to 2012

Water Year	Days of Spilling	40-30-30 Index
1978	5	AN
1979	0	BN
1980	0	AN
1981	0	D
1982	63	W
1983	81	W
1984	0	W
1985	0	D
1986	17	W
1987	0	D
1988	0	C
1989	0	D
1990	8	C

Water Year	Days of Spilling	40-30-30 Index
1991	0	C
1992	0	C
1993	10	AN
1994	0	C
1995	14	W
1996	0	W
1997	5	W
1998	8	W
1999	0	W
2000	0	AN
2001	0	D
2002	0	D
2003	8	AN
2004	0	BN
2005	0	AN
2006	4	W
2007	0	D
2008	0	C
2009	0	D
2010	6	BN
2011	0	W
2012	0	BN

Note: W = Wet Year Water Year Type; AN = Above Normal Water Year Type; BN = Below Normal Water Year Type; D = Dry Water Year Type; and C = Critical Dry Water Year Type.

Operations at Whiskeytown Lake during flood conditions are complicated by its operational relationship with the Trinity River, Sacramento River, and Clear Creek. On occasion, imports of Trinity River water to Whiskeytown Reservoir may be suspended to avoid aggravating high flow conditions in the Sacramento Basin. Joint temperature control objectives also similarly interact among the Trinity River, Clear Creek, and Sacramento River.

3A.4.3.1.6 Fish and Wildlife Requirements on Clear Creek

CVPIA (b)(2) operations and water rights permits issued by the SWRCB for diversions from Trinity River and Clear Creek specify minimum downstream releases from Lewiston and Whiskeytown Dams, respectively. The following agreements govern releases from Whiskeytown Lake.

- A 1960 Memorandum of Agreement (MOA) with CDFW established minimum flows to be released to Clear Creek at Whiskeytown Dam, as summarized in Table 3A.4.

- A 1963 release schedule for Whiskeytown Dam was developed with USFWS and implemented, but never finalized. Although this release schedule was never formalized, Reclamation has used this flow schedule for minimum flows since May 1963.
- Water rights permit modification in 2002 that allowed release of water from Whiskeytown Lake into Clear Creek for the purposes of maintenance of fish and wildlife resources as provided for in Provision 2.1 of Instream Flow Preservation Agreement by and among Reclamation, USFWS, and DFW, dated August 11, 2000.
- Dedication of (b)(2) water on Clear Creek provides instream flows below Whiskeytown Dam greater than the minimum flows (that would have occurred under pre-CVPIA regulations). Instream flow objectives are usually taken from the AFRP plan, in consideration of spawning and incubation of fall-run Chinook Salmon. Augmentation in the summer months is usually in consideration of water temperature objectives for steelhead and in late summer for spring-run Chinook Salmon.

Table 3A.4 Minimum Flows at Whiskeytown Dam

Period	Minimum flow (cfs)
1960 MOA with CDFW	
January 1–February 28(29)	50
March 1–May 31	30
June 1–September 30	0
October 1–October 15	10
October 16–October 31	30
November 1–December 31	100
1963 USFWS Proposed Normal year flow	
January 1–October 31	50
November 1–December 31	100
1963 USFWS Proposed Critical year flow	
January 1–October 31	30
November 1–December 31	70
2002 Water Right Modification for Critical year flow	
January 1–October 31	50
November 1–December 31	70

The 2009 NMFS BO RPA requires Reclamation to release spring attraction flows for adult spring-run Chinook Salmon (Action I.1.1) and channel maintenance flows in Clear Creek (Action I.1.2); and to continue gravel augmentation programs initiated under CVPIA. The spring attraction flows are to be released from Whiskeytown Lake into Clear Creek in at least two pulse flows of at least 600 cfs, each lasting at least 3 days, in May and June.

Under the 2009 NMFS BO RPA, the channel maintenance flows are to be released at a minimum flow of 3,250 cfs for 24 hours, which exceeds the 1,240 cfs capacity of the Whiskeytown Dam outlet to Clear Creek. This action is to occur seven times in a ten year period. Therefore, to provide channel maintenance flows, the Whiskeytown Lake water elevation must be increased to provide flow of water over the Glory Hole inlet. The Glory Hole is designed to operate with the higher water elevations expected during flood events. However, during non-flood periods, raising the water elevations and operating the Glory Hole inlet can cause safety concerns for recreationists both along the Whiskeytown Lake shoreline.

3A.4.3.1.7 Spring Creek Debris Dam Operations

The Spring Creek Debris Dam (SCDD) is a feature of the Trinity Division of the CVP. It was constructed to regulate runoff containing debris and acid mine drainage from Spring Creek, a tributary to the Sacramento River that enters Keswick Reservoir. The SCDD can store approximately 5.8 TAF of water. Operation of SCDD and Shasta Dam has allowed some control of the toxic wastes with dilution criteria. In January 1980, Reclamation, CDFW, and SWRCB executed a Memorandum of Understanding (MOU) to implement actions that protect the Sacramento River system from heavy metal pollution from Spring Creek and adjacent watersheds. The MOU identifies agency actions and responsibilities, and establishes release criteria based on allowable concentrations of total copper and zinc in the Sacramento River below Keswick Dam.

The MOU states that Reclamation agrees to operate to dilute releases from SCDD (according to the criteria and schedules provided), that such operation would not cause flood control parameters on the Sacramento River to be exceeded, and would not unreasonably interfere with other Project requirements as determined by Reclamation. The MOU also specifies a minimum schedule for monitoring copper and zinc concentrations at SCDD and in the Sacramento River below Keswick Dam. Reclamation has primary responsibility for the monitoring; however, CDFW and RWQCB also collect and analyze samples on an as-needed basis. Due to more extensive monitoring, improved sampling and analysis techniques, and continuing cleanup efforts in the Spring Creek drainage basin, Reclamation now operates SCDD to target the more stringent Central Valley Region Water Quality Control Board Plan (CVRWQCB Basin Plan) criteria in addition to the MOU goals. Instead of the total copper and total zinc criteria contained in the MOU, Reclamation operates SCDD releases and Keswick dilution flows to not exceed the CVRWQCB Basin Plan standards of 0.0056 milligrams per liter (mg/L) dissolved copper and 0.016 mg/L dissolved zinc. Release rates are estimated from a mass balance calculation of the copper and zinc in the debris dam release and in the river.

In order to minimize the build-up of metal concentrations in the Spring Creek arm of Keswick Reservoir, releases from the debris dam are coordinated with releases from the Spring Creek Power Plant to keep the Spring Creek arm of Keswick Reservoir in circulation with the main water body of Keswick Lake.

The operation of SCDD is complicated during major heavy rainfall events. SCDD reservoir can fill to uncontrolled spill elevations in a relatively short time period, anywhere from days to weeks. Uncontrolled spills at SCDD can occur during major flood events on the upper Sacramento River and also during localized rainfall events in the Spring Creek watershed. During flood control events, Keswick releases may be reduced to meet flood control objectives at Bend Bridge when storage and inflow at Spring Creek Reservoir are high.

Because SCDD releases are maintained as a dilution ratio of Keswick releases to maintain the required dilution of copper and zinc, uncontrolled spills can and have occurred from SCDD. In this operational situation, high metal concentration loads during heavy rainfall are usually limited to areas immediately downstream of Keswick Dam because of the high runoff entering the Sacramento River, adding dilution flow. In the operational situation when Keswick releases are increased for flood control purposes, SCDD releases are also increased in an effort to reduce spill potential.

In the operational situation when heavy rainfall events would fill SCDD and Shasta Lake would not reach flood control conditions, increased releases from CVP storage may be required to maintain desired dilution ratios for metal concentrations. Reclamation has voluntarily released additional water from CVP storage to maintain release ratios for toxic metals below Keswick Dam. Reclamation has typically attempted to meet the CVRWQCB Basin Plan standards but these releases have no established criteria and are dealt with on a case-by-case basis. Since water released for dilution of toxic spills is likely to be in excess of other CVP requirements, such releases increase the risk of a loss of water for other beneficial purposes.

3A.4.3.2 Shasta Division and Sacramento River Division

The CVP's Shasta Division includes facilities that conserve water in the Sacramento River for:

- Flood control
- Navigation maintenance
- Agricultural water supplies
- M&I water supplies
- Hydroelectric power generation
- Conservation of fish in the Sacramento River
- Protection of the Delta from intrusion of saline ocean water.

The Shasta Division includes Shasta Dam, Lake, and Power Plant; Keswick Dam, Reservoir, and Power Plant, and the Shasta Temperature Control Device.

The Sacramento River Division was authorized after completion of the Shasta Division. The Sacramento River Division includes facilities for the diversion and conveyance of water to CVP contractors on the west side of the Sacramento River. The division includes the Sacramento Canals Unit, which was authorized in 1950 and consists of the Red Bluff Pumping Plant, the Corning Pumping Plant, and the Corning and Tehama-Colusa Canals. Total authorized diversions for the Sacramento River Division 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, including diversions by Sacramento River Settlement contractors and CVP water service contractors. Sacramento River Settlement contractors divert water under their own water rights and through their own facilities.

The Sacramento Canals 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 inter-relationships.

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 MAF. Water in Shasta Lake is released through or around the Shasta Power Plant 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 23.8 TAF and serves as an afterbay for releases from Shasta Dam and for discharges from the Spring Creek Power Plant. All releases from Keswick Reservoir are made to the Sacramento River from Keswick Dam. The dam has a fish trapping facility that operates in conjunction with the Coleman National Fish Hatchery on Battle Creek.

3A.4.3.2.1 Flood Control

Flood control objectives for Shasta Lake require that releases be restricted to quantities that would not cause downstream flows or stages to exceed specified levels. These include a flow of 79,000 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.

Flood control operation at Shasta Lake requires forecasting runoff conditions into Shasta Lake and runoff conditions of unregulated creek systems downstream from Keswick Dam as far in advance as possible. A critical element of upper Sacramento River flood operations is the local runoff entering the Sacramento River between Keswick Dam and Bend Bridge.

The unregulated creeks (major creek systems are Cottonwood Creek, Cow Creek, and Battle Creek) in this reach of the Sacramento River can be very sensitive to a large rainfall event and produce high rates of runoff into the Sacramento River in short time periods. During large rainfall and flooding events, the local runoff between Keswick Dam and Bend Bridge can exceed 100,000 cfs.

The travel time required for release changes at Keswick Dam to affect Bend Bridge flows is approximately 8 to 10 hours. If the total flow at Bend Bridge is projected to exceed 100,000 cfs, the release from Keswick Dam is decreased to maintain Bend Bridge flow below 100,000 cfs. As the flow at Bend Bridge is projected to recede, the Keswick Dam release is increased to evacuate water stored in the flood control space at Shasta Lake. Changes to Keswick Dam releases are scheduled to minimize rapid fluctuations in the flow at Bend Bridge.

The flood control criteria for Keswick releases specify that releases should not be increased more than 15,000 cfs or decreased more than 4,000 cfs in any 2-hour period. The restriction on the rate of decrease is intended to prevent sloughing of saturated downstream channel embankments caused by rapid reductions in river stage. In rare instances, the rate of decrease may have to be accelerated to avoid exceeding critical flood stages downstream.

3A.4.3.2.2 Fish and Wildlife Requirements in the Sacramento River

Reclamation operates the Shasta, Sacramento River, and Trinity River divisions of the CVP to meet (to the extent possible) the provisions of SWRCB Order 90-05. An April 5, 1960, MOA between Reclamation and CDFW 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 (Table 3A.5). 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 SWRCB Order 90-05, which maintains a minimum release of 3,250 cfs at Keswick Dam and Red Bluff Pumping Plant from September through the end of February in all water years except critically dry years.

Table 3A.5 Minimum Flow Requirements and Objectives (cfs) on the Sacramento River below Keswick Dam

Period	MOA	Water Rights 90-5	MOA and Water Rights 90-5
Water Year Type	**Normal**	**Normal**	**Critically Dry**
January 1–February 28(29)	2,600	3,250	2,000
March 1–March 31	2,300	2,300	2,300
April 1–April 30	2,300	2,300	2,300
May 1–August 31	2,300	2,300	2,300
September 1–September 30	3,900	3,250	2,800
October 1–November 30	3,900	3,250	2,800
December 1–December 31	2,600	3,250	2,000

The 1960 MOA between Reclamation and CDFW provides that releases from Keswick Dam (from September 1 through December 31) are made with minimum water level fluctuation or change to protect salmon to the extent compatible with other operations requirements.

Reclamation usually attempts to reduce releases from Keswick Dam to the minimum fishery requirement by October 15 each year and to minimize changes in Keswick releases between October 15 and December 31. Releases may be increased during this period to meet downstream needs such as higher outflows in the Delta to meet water quality requirements, or to meet flood control requirements. Releases from Keswick Dam may be reduced when downstream tributary inflows increase to a level that would meet flow needs. Reclamation attempts to establish a base flow that minimizes release fluctuations to reduce impacts to fisheries and bank erosion from October through December.

The Connelly-Areias-Chandler Rice Straw Burning Reduction Act of 1991 changed agricultural water diversion practices along the Sacramento River and has affected Keswick Dam release rates in the fall. This program is generally known as the Rice Straw Decomposition and Waterfowl Habitat Program. Prior to this change, the preferred method of clearing fields of rice stubble was to systematically burn it. Today, rice field burning has been phased out due to air quality concerns and has been replaced in some areas by a program of rice field flooding that decomposes rice stubble and provides additional waterfowl habitat. The result has been an increase in water demand to flood rice fields in October and November, which has increased the need for higher Keswick releases in all but the wettest of fall months.

3A.4.3.2.3 Minimum Flow for Navigation as Measured at Wilkins Slough

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 in accordance with references to Sacramento River Division operations in the River and Harbors Act of 1935 and the Rivers and Harbors Act of 1937. Currently, there is no commercial traffic between Sacramento and Chico Landing, and 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 and cannot easily divert when lower river elevations occur with lower flows. 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.

Implementation of 2009 National Marine Fisheries Service Biological Opinion

The 2009 NMFS BO Action I.4 required Reclamation to evaluate approaches to provide minimum flows at Wilkins Slough of less than 5,000 cfs.

3A.4.3.2.4 Water Temperature Operations in the Upper Sacramento River

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 Power Plant. The temperature of water released from Shasta Dam and the Spring Creek Power Plant 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 in the Sacramento River. Water temperature in the upper Sacramento River is governed by current water rights permit requirements.

In 1990 and 1991, SWRCB issued Water Rights Orders 90-05 and 91-01 modifying Reclamation's water rights for the Sacramento River. The orders stated that Reclamation shall operate Keswick and Shasta Dams and the Spring Creek Power Plant 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 Pumping Plant.

Under the orders, the water temperature compliance point may be modified when the objective cannot be met at Red Bluff Pumping Plant. In addition, SWRCB Order 90-05 modified the minimum flow requirements initially established in the 1960 MOA for the Sacramento River below Keswick Dam. The water right orders also recommended the construction of a Shasta Temperature Control Device (TCD) to improve the management of the limited cold water resources.

Pursuant to SWRCB Orders 90-05 and 91-01, Reclamation configured and implemented the Sacramento-Trinity Water Quality Monitoring Network to monitor temperature and other parameters at key locations in the Sacramento and Trinity Rivers. SWRCB orders also required Reclamation to establish the SRTTG to formulate, monitor, and coordinate temperature control plans for the upper Sacramento and Trinity Rivers. This group consists of representatives from Reclamation, SWRCB, NMFS, USFWS, CDFW, Western, DWR, and the Hoopa Valley Indian Tribe.

Each year, with finite cold water resources and competing demands usually an issue, the SRTTG devise operation plans with the flexibility to provide the best protection consistent with the CVP's temperature control capabilities and considering the annual needs and seasonal spawning distribution monitoring information for winter-run and fall-run Chinook Salmon. In every year since SWRCB issued the orders, those plans have included modifying the Red Bluff Pumping Plant compliance point to make best use of the cold water resources based on the location of spawning Chinook Salmon. Reports are submitted periodically to SWRCB over the temperature control season defining our temperature operation plans. SWRCB has overall authority to determine if the plan is sufficient to meet water right permit requirements.

Implementation of 2009 National Marine Fisheries Service Biological Opinion

The 2009 NMFS BO RPA Action I.2.1 requires Reclamation to achieve the following carryover storage performance measures for Shasta Lake to maintain the cold water volume needed to meet downstream temperature requirements.

- 87 percent of the years: 2,200 TAF end-of-September storage
- 82 percent of the years: .2,200 TAF end-of-September storage and 3,800 TAF end-of-April storage in following year
- 40 percent of the years: 3,200 TAF end-of-September storage

The 2009 NMFS BO RPA requires Reclamation to achieve the following temperature requirements over a ten year running average.

- 95 percent of the years: Clear Creek temperature compliance
- 85 percent of the years: Ball's Ferry temperature compliance
- 40 percent of the years: Jelly's Ferry temperature compliance
- 15 percent of the years: Bend Bridge temperature compliance

From November through February, if the end-of-September storage in Shasta Lake is equal to or greater than 2,400 TAF by October 15, Reclamation is required to work with NMFS, and CDFW to develop a release schedule that would consider the need to maintain flood control space in Shasta Lake (which results in a maximum storage of 3,250 TAF at the end-of-November), and a the need to provide stable Sacramento River flows and elevations during this period.

If the end-of-September storage in Shasta Lake is between 1,900 and 2,400 TAF, a monthly release schedule for this period must be developed to consider maintaining Keswick Reservoir releases between 3,250 and 7,000 cfs; flows to support fall-run Chinook Salmon in accordance with the CVPIA AFRP guidelines; and provide for conservative Keswick Reservoir releases in drier years. If end-of-September storage in Shasta Lake is less than 1,900 TAF, Keswick Reservoir releases are reduced to 3,250 cfs in early October unless the flows are needed for temperature compliance, and if needed, reduce discretionary deliveries; and develop projected monthly deliveries for the period to maintain releases of 3,250 cfs, and if needed, reduce CVP and SWP Delta exports to meet Delta outflow and other legal requirements.

From April 15 through May 15, water temperatures are to be maintained at 56° F between Ball's Ferry and Bend Bridge. In addition, in March, Reclamation uses projections of CVP water availability, based upon a 90 percent forecast, to project the ability to meet temperature compliance at Ball's Ferry and achieve an end-of-September storage in Shasta Lake of 2,200 TAF. If the projections indicate that only one of the objectives can be met, releases from Keswick Reservoir would be reduced to 3,250 cfs unless another release pattern is agreed upon with NMFS. The release pattern would consider actions to maintain monthly average flows for Reclamation's non-discretionary delivery obligations; provide flows for the biological needs of spring life stages of species addressed in the 2009 NMFS BO; and approaches, including reductions in Delta exports, to meet Delta outflow and other legal requirements while not reducing Keswick Reservoir releases. If the projections indicate that the Clear Creek temperature compliance point or the 1,900 TAF end-of-September Shasta Lake storage cannot be met, Reclamation would develop a plan to manage the cold water pool in Whiskeytown Reservoir and Shasta Lake through several operational changes, including a reduction in the Wilkins Slough flow criteria (discussed above) to 4,000 cfs.

For operations from May 15 through October, Reclamation would develop a Temperature Management Plan to achieve temperatures of 56° F or less at compliance locations between Ball's Ferry and Bend Bridge.

3A.4.3.2.5 Shasta Temperature Control Device

Construction of the 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.

Prior to construction of the Shasta TCD, Reclamation released water from Shasta Dam's low-level river outlets to alleviate high water temperatures during critical periods of the spawning and incubation life stages of the winter-run Chinook Salmon stock. The release of water through the low-level river outlets was a major facet of Reclamation's efforts to control upper Sacramento River temperatures from 1987 through 1996. Releases through the low-level outlets bypass the power plant and result in a loss of hydroelectric generation at the Shasta Power Plant.

The seasonal operation of the TCD is generally as follows: during mid-winter and early spring the highest possible elevation gates are utilized to draw from the upper portions of the lake to conserve deeper colder resources (Table 3A.6). During late spring and summer, the operators begin the seasonal progression of opening deeper gates as Shasta Lake elevation decreases and cold water resources are utilized. In late summer and fall, the TCD side gates are opened to utilize the remaining cold water resource below the Shasta Power Plant elevation in Shasta Lake.

Table 3A.6 Shasta Temperature Control Device Gates with Elevation and Storage

TCD Gates	Shasta Elevation with 35 feet of Submergence (feet)	Shasta Storage (MAF)
Upper Gates	1,035	~3.65
Middle Gates	935	~2.50
Pressure Relief Gates	840	~0.67
Side Gates	720*	~0.01

*Low level intake bottom

The seasonal progression of the Shasta TCD operation is designed to maximize the conservation of cold water resources deep in Shasta Lake, until the time the resource is of greatest management value for fishery management purposes. Recent operational experience with the Shasta TCD has demonstrated significant operational flexibility improvement for cold water conservation and upper Sacramento River water temperature and fishery habitat management purposes. Recent operational experience has also demonstrated the Shasta TCD has significant leaks that are inherent to TCD design. Also, operational uncertainties cumulatively impair the seasonal performance of the Shasta TCD to a greater degree than was anticipated in previous analysis and modeling used to describe long-term Shasta TCD benefits.

3A.4.3.2.6 CVPIA 3406 (b)(2) Operations on the Upper Sacramento River

Dedication of (b)(2) water on the Sacramento River provides instream flows below Keswick Dam greater than those that would have occurred under pre-CVPIA regulations, e.g., the fish and wildlife requirements specified in SWRCB Order 90-5 and the temperature criteria formalized in the 1993 NMFS winter-run Chinook Salmon BO as the base. Instream flow objectives from October 1 to April 15 (typically April 15 is when water temperature objectives for winter-run Chinook Salmon become the determining factor) are usually selected to minimize dewatering of redds and provide suitable habitat for salmonid spawning, incubation, rearing, and migration.

3A.4.3.2.7 Anderson-Cottonwood Irrigation District Diversion Dam

Anderson Cottonwood Irrigation District (ACID) holds senior water rights and has diverted into the ACID Canal for irrigation along the west side of the Sacramento River between Redding and Cottonwood since 1916. The United States and ACID signed a contract providing for Project water service and agreement on diversion of water. ACID diverts to its main canal (on the right bank of the river) from a diversion dam located in Redding about 5 miles downstream from Keswick Dam.

Close coordination between Reclamation and ACID is required for regulation of river flows to ensure safe operation of ACID's diversion dam during the irrigation season. The irrigation season for ACID runs from April through October.

Keswick release rate decreases required for the ACID operations are limited to 15 percent in a 24-hour period and 2.5 percent in any one hour. Therefore, advance notification is important when scheduling decreases to allow for the installation or removal of the ACID diversion dam.

Red Bluff Pumping Plant

The Red Bluff Pumping Plant and Fish Screen were completed in August 2012 to replace the Red Bluff Diversion Dam and improve fish passage conditions on the Sacramento River at Red Bluff, California. The facility includes a 1,118-foot-long flat-plate fish screen, intake channel, 2,500 cfs capacity pumping plant and discharge conduit to divert water from the Sacramento River into the Tehama-Colusa and Corning canals.

In 2011, the dam gates were permanently placed in the open position for free migration of fish while ensuring continued water deliveries by way of the Red Bluff Pumping Plant.

3A.4.3.2.8 Tehama-Colusa Canal Authority Operations

The intake for the Tehama-Colusa Canal and the Corning Canal is located on the Sacramento River approximately 2 miles southeast of Red Bluff. Water is diverted through fish passage facilities along the Sacramento River and lifted by a 2,500 cfs pumping plant into a settling basin for continued conveyance in the Tehama-Colusa Canal and the Corning Canal. Reclamation operates the pumping plant in accordance with BOs issued by USFWS and NMFS specifically for the Red Bluff Pumping Plant.

The Tehama-Colusa Canal is a lined canal extending from the settling basin 111 miles south from the Red Bluff Pumping Plant and provides irrigation service on the west side of the Sacramento Valley in Tehama, Glenn, Colusa, and northern Yolo counties. Construction of the Tehama-Colusa Canal began in 1965, and it was completed in 1980.

The Corning Pumping Plant lifts water approximately 56 feet from the screened portion of the settling basin into the unlined, 21 mile-long Corning Canal. The Corning Canal was completed in 1959, to provide water to the CVP contractors in

Tehama County that could not be served by gravity from the Tehama-Colusa Canal. The Tehama-Colusa Canal Authority (TCCA) operates both the Tehama-Colusa and Corning canals.

3A.4.3.3 American River Division

Reclamation's Folsom Reservoir, the largest reservoir in the American River watershed, has a capacity of 967 TAF. 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 Power Plant; Nimbus Dam and Power Plant, and Lake Natoma.

Table 3A.7 provides Reclamation's annual water deliveries for the period 2000 through 2010 in the American River Division. The totals reveal an increasing trend in water deliveries over that period. For this EIS under the No Action Alternative, the American River Division water demands are modeled assuming that water users can utilize their full contract/agreement values with average annual deliveries of about 800 TAF per year. However, the American River contractors are not currently using this volume. The modeled deliveries vary depending on modeled annual water allocations. The "present level of American River water demands" has been previously modeled at 325 TAF/year based upon information collected over 10 years ago. The recently completed Urban Water Management Plans (UWMPs) for the American River water users indicate that the current average annual water use is about 500 TAF/year. It is anticipated that due to fast growth and new water agreements, the actual usage (as projected by the UWMPs) could increase to about 650 to 800 TAF/year over the next 10 years, depending upon growth rates and implementation of water demand reduction measures.

Table 3A.7 Annual Water Delivery—American River Division

Year	Water Delivery (TAF)*
2000	174
2001	223
2002	221
2003	270
2004	266
2005	297
2006	280
2007	113
2008	233
2009	260
2010	125
2011	269
2012	279

* Annual Water Delivery data has been enhanced and the annual totals include CVP contracts, water rights (including water rights for the City of Sacramento), and other deliveries (e.g., Folsom South Canal losses).

TAF = thousand acre-feet

Releases from Folsom Dam are re-regulated approximately 7 miles downstream by Nimbus Dam. This facility is also operated by Reclamation as part of the CVP. Nimbus Dam creates Lake Natoma, which serves as a forebay for diversions to the Folsom South Canal. This CVP facility serves water to M&I users in Sacramento County. Releases from Nimbus Dam to the American River pass through the Nimbus Power Plant, or, at flows in excess of 5,000 cfs, the spillway gates.

Although Folsom Reservoir is the main storage and flood control reservoir on the American River, numerous other small non-federal reservoirs in the upper basin provide hydroelectric generation and water supply. None of the upstream reservoirs have any specific flood control responsibilities. The total upstream reservoir storage above Folsom Reservoir is approximately 820 TAF. Ninety percent of this upstream storage is contained by five reservoirs: French Meadows (136 TAF); Hell Hole (208 TAF); Loon Lake (76 TAF); Union Valley (271 TAF); and Ice House (46 TAF). Reclamation has agreements with the operators of some of these reservoirs to coordinate operations for releases.

French Meadows and Hell Hole reservoirs, located on the Middle Fork of the American River, are owned and operated by the Placer County Water Agency (PCWA). The PCWA provides wholesale water to agricultural and urban areas within Placer County. For urban areas, PCWA operates water treatment plants and sells wholesale treated water to municipalities that provide retail delivery to their customers. The cities of Rocklin and Lincoln receive water from PCWA, Loon Lake, and Union Valley and Ice House reservoirs on the South Fork of the American River, are all operated by the Sacramento Municipal Utilities District (SMUD) for hydropower purposes.

3A.4.3.3.1 Flood Control

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). Flood control objectives for the Folsom unit require that the dam and lake be operated to:

- Protect the City of Sacramento and other areas within the Lower American River floodplain against reasonable probable rain floods.
- Control flows in the American River downstream from Folsom Dam to existing channel capacities, insofar as practicable, and reduce flooding along the lower Sacramento River and in the Delta in conjunction with other CVP Projects.
- Provide the maximum amount of water conservation storage without impairing the flood control functions of the reservoir.
- Provide the maximum amount of power practicable and be consistent with required flood control operations and the conservation functions of the reservoir.

From June 1 through September 30, no flood control storage restrictions exist. From October 1 through November 16 and from April 20 through May 31, reserving storage space for flood control is a function of the date only, with full flood reservation space required from November 17 through February 7. Beginning February 8 and continuing through April 20, flood reservation space is a function of both date and current hydrologic conditions in the basin.

If the inflow into Folsom Reservoir causes the storage to encroach into the space reserved for flood control, releases from Nimbus Dam are increased. Flood control regulations prescribe the following releases when water is stored within the flood control reservation space.

- Maximum inflow (after the storage entered into the flood control reservation space) of as much as 115,000 cfs, but not less than 20,000 cfs, when inflows are increasing.
- Releases would not be increased more than 15,000 cfs or decreased more than 10,000 cfs during any two-hour period.
- Flood control requirements override other operational considerations in the fall and winter period. Consequently, short-term changes in river releases may occur.

In February 1986, the American River Basin experienced a significant flood event. Folsom Dam and Folsom Reservoir moderated the flood event and performed the flood control objectives, but with serious operational strains and concerns in the Lower American River and for 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 have occurred and are ongoing. 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 TAF of flood control space in Folsom Reservoir in combination with three upstream reservoirs. This flood control plan, which provides additional protection for the Lower American River, is implemented through an agreement between Reclamation and SAFCA. The terms of the agreement allow some of the empty reservoir space in Hell Hole, Union Valley, and French Meadows to be treated as if it were available in Folsom Reservoir.

The SAFCA release criteria are generally equivalent to the USACE plan, except the SAFCA diagram may prescribe flood releases earlier than the USACE plan. The SAFCA diagram also relies on Folsom Dam outlet capacity to make the earlier flood releases. The outlet capacity at Folsom Dam is currently limited to 32,000 cfs based on lake elevation. However, in general the SAFCA plan diagram provides greater flood protection than the existing USACE plan for communities in the American River floodplain.

Required flood control space under the SAFCA diagram begin to decrease on March 1. Between March 1 and April 20, the rate of filling is a function of the date and available upstream space. As of April 21, the required flood reservation is about 225 TAF. From April 21 to June 1, the required flood reservation is a function of the date only, with Folsom Reservoir storage permitted to fill completely on June 1.

Reclamation and USACE are jointly working on construction of an auxiliary spillway at Folsom Dam that would assist in meeting the established flood damage reduction objectives for the Sacramento area while continuing to preserve and expedite safely passing the Probable Maximum Flood. This project is commonly referred as the Joint Federal Project. Other partners in this project include DWR and SAFCA.

USACE (and Reclamation as the National Environmental Policy Act [NEPA] cooperating agency) is also undertaking a Folsom Dam Reoperation Study to develop, evaluate, and recommend changes to the flood control operations of the Folsom Dam project that would further the goal of reduced flood risk for the Sacramento area. Operational changes may be necessary to fully realize the flood risk reduction benefits of the additional operational capabilities created by completion of the Joint Federal Project, and the increased system capabilities provided by the implemented and authorized features of the Common Features Project (a project being carried out by USACE and designed to strengthen the American River levees so they can safely pass a flow of 160,000 cfs); and those anticipated to be provided by completion of the authorized Folsom Dam Mini-Raise Project. The Folsom Dam Reoperation Study would also consider improved forecasts from the National Weather Service. Once a modified flood operation plan is complete, USACE, in cooperation with Reclamation (and DWR as the California Environmental Quality Act [CEQA] lead and SAFCA as the local partner), would consult with USFWS and NMFS relative to any changes to American River and/or system-wide CVP operations that may result.

Additional information related to the flood control criteria for Folsom Dam operations is included by reference to documents prepared by the USACE and SAFCA.

3A.4.3.3.2 Fish and Wildlife Requirements in the Lower American River

The minimum allowable flows in the Lower American River are defined by SWRCB Water Right 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 CVP and SWP releases to meet downstream SWRCB 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 and other stakeholders completed a draft technical report establishing a flow and temperature regime intended to improve conditions for fish in the lower American River (i.e., the Lower American River Flow Management Standard [FMS]). Reclamation began operating to the FMS immediately thereafter. The modeling assumptions herein include the operational components of the minimum Lower American River flows, consistent with the proposed FMS. The Sacramento Area Water Forum is currently investigating a revised FMS to better address temperature concerns on the Lower American River. Environmental compliance documentation is currently in the early stages of development. The FMS flows may be met by releases of water pursuant to Section 3406 (b)(2) of the CVPIA, if necessary.

Use of additional (b)(2) flows above the proposed flow standard is envisioned only on a case-by-case basis. Such additional use of (b)(2) flows would be subject to available resources and such use would be coupled with plans to not intentionally cause significantly lower river flows later in a water year. This case-by-case use of additional (b)(2) for minimum flows is not included in the modeling results.

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, Folsom Dam Urban Water Supply TCD management, and Nimbus Hatchery considerations. Shutter and TCD management provide the majority of operational flexibility used to control downstream temperatures.

During the late 1960s, Reclamation designed a modification to the trashrack structures to provide selective withdrawal capability at Folsom Dam. Folsom Power Plant is located at the foot of Folsom Dam on the right abutment. Three 15-foot-diameter steel penstocks for delivering water to the turbines are embedded in the concrete section of the dam. The centerline of each penstock intake is at elevation 307.0 feet and the minimum power pool elevation is 328.5 feet. A reinforced concrete trashrack structure with steel trashracks protects each penstock intake.

The steel trashracks, located in five bays around each intake, extend the full height of the trashrack structure (between 281 and 428 feet). Steel guides were attached to the upstream side of the trashrack panels between elevation 281 and 401 feet. Forty-five 13-foot steel shutter panels (nine per bay), which are operated by a gantry crane, were installed in these guides to select the level of withdrawal from the reservoir. The shutter panels are attached to one another, in a configuration starting with the top shutter, in groups of three, two, and four.

Selective withdrawal capability on the Folsom Dam Urban Water Supply Pipeline (also known as the TCD) became operational in 2003. The centerline to the 84-inch-diameter Urban Water Supply intake is at elevation 317 feet. An enclosure structure extending from just below the water supply intake to an elevation of 442 feet was attached to the upstream face of Folsom Dam. A telescoping control gate allows for selective withdrawal of water anywhere between 331 and 401 feet elevation under normal operations.

The current objectives for water temperatures in the Lower American River address the needs for steelhead incubation and rearing during the late spring and summer, and for fall–run Chinook Salmon spawning and incubation starting in late October or early November.

A major challenge is determining the starting date at which time the objective is met. Establishing the start date requires a balancing between forecasted release rates, the volume of available cold water, and the estimated date at which time Folsom Reservoir turns over and becomes isothermic. Reclamation works to provide suitable spawning temperatures as early as possible (after November 1) to help avoid temperature related pre-spawning mortality of adults and reduced egg viability. Operations are balanced against the possibility of running out of cold water and increasing downstream temperatures after spawning is initiated and creating temperature-related effects on eggs already in the gravel.

In any given year at Folsom Reservoir, the available cold water resources needed to meet the stated water temperature goals are often insufficient. Only in wetter hydrologic conditions is the volume of cold water resources available sufficient to meet all the water temperature objectives. Therefore, significant operations tradeoffs and flexibilities are part of an annual planning process for coordinating an operation strategy that realistically manages the limited cold water resources available. Reclamation's coordination on the planning and management of cold water resources is done through the (b)(2)IT and ARG groups discussed above.

The management process begins in the spring as Folsom Reservoir fills. All penstock shutters are put in the down position to isolate the colder water in the reservoir below an elevation of 401 feet. The reservoir water surface elevation must be at least 25 feet higher than the sill of the upper shutter (426 feet) to avoid cavitation of the power turbines. The earliest this can occur is in the month of March, due to the need to maintain flood control space in the reservoir during the winter. The pattern of spring run-off is then a significant factor in determining the availability of cold water for later use. Folsom Reservoir inflow temperatures begin to increase and the lake starts to stratify as early as April. By the time the reservoir is filled or reaches peak storage (sometime in the May through June period), the reservoir is highly stratified, with surface waters too warm to meet downstream temperature objectives. There are, however, times during the filling process when use of the spillway gates can be used to conserve cold water.

In the spring of 2003, high inflows and encroachment into the allowable storage space for flood control required releases that exceeded the available capacity of the power plant. Under these conditions, Folsom Dam standard operations involve the use of the river outlets that draw upon the cold water pool. Reclamation reviewed the release requirements, Safety of Dams issues, reservoir water temperature conditions, and the cold water pool benefits, and determined that the spillway gates should be used to make the incremental releases above power plant capacity, thereby conserving cold water for later use. The ability and necessity to take similar actions are evaluated on a case-by-case basis.

The annual temperature management strategy and challenge is to balance conservation of cold water for later use in the fall with the more immediate needs of steelhead during the summer. The planning and forecasting process for the use of the cold water pool begins in the spring as Folsom Reservoir fills. Actual Folsom Reservoir cold water resource availability becomes significantly more defined through the assessment of reservoir water temperature profiles and more definite projections of inflows and storage. Technical modeling analysis begins in the spring for the projected Lower American River water temperature management plan. The significant variables and key assumptions in the analysis include:

- Cold Water Pool volume in March
- Starting reservoir temperature conditions
- Forecasted inflow and outflow quantities
- Assumed meteorological conditions
- Assumed inflow temperatures
- Assumed Folsom Dam Water Supply Intake TCD operations

A series of TCD shutter management scenarios are then incorporated into a model to gain a better understanding of the potential for meeting water temperature needs for both over-summer rearing steelhead and spawning Chinook Salmon in the fall. Most annual strategies contain significant tradeoffs and risks for water temperature management for steelhead and fall-run Chinook Salmon goals and needs due to the frequently limited coldwater resource. The planning process continues throughout the summer. New temperature forecasts and operational strategies are updated as more information on actual operations and ambient conditions is gained.

Meeting both the summer steelhead and fall salmon temperature objectives without negatively impacting other CVP project purposes requires the final shutter pull be reserved for use in the fall to provide suitable fall-run Chinook Salmon spawning temperatures. In most years, the volume of cold water is not sufficient to support strict compliance with the summer water temperature target at the downstream end of the compliance reach at the Watt Avenue Bridge; while at the same time reserving adequate water for fall releases to protect fall-run Chinook Salmon, or in some cases, continuing to meet steelhead over-summer rearing objectives later in the summer. A strategy used under these conditions is to allow the annual compliance location water temperatures to warm towards the upper end of the annual water temperature design value before making a shutter pull. This management flexibility is essential to the annual management strategy to extend the effectiveness of cold water management through the summer and fall months.

The Folsom Water Supply Intake TCD has provided additional flexibility to conserve cold water for later use. As anticipated, the TCD has been operated during the summer months and delivers water that is slightly warmer than that which could be used to meet downstream temperatures (60°F to 62°F), but not so warm as to cause significant treatment issues.

Water temperatures feeding the Nimbus Fish Hatchery were historically too high for hatchery operations during some dry or critical years. Water temperatures in the Nimbus Hatchery are generally in the desirable range of 42°F to 55°F, except for the months of June, July, August, and September. When temperatures get above 60°F during these months, the hatchery must begin to treat the fish with chemicals to prevent disease. When temperatures reach the 60°F to 70°F range, treatment becomes difficult and conditions become increasingly dangerous for the fish. In years when mean daily water temperatures are forecast to approach 70°F, a significant number of steelhead may be released early in the summer. Stocked fish have the opportunity to find suitable rearing habitat within the river and reduced densities result in lower mortality in the group of fish that remain in the hatchery.

Reclamation operates Nimbus Dam Fish Hatchery to maintain the health of the hatchery fish while minimizing the loss of the coldwater pool for fish spawning in the river during fall. Evaluation of Nimbus Dam operations is done on a case-by-case basis and is different in various months and year types. Water temperatures above 70°F in the hatchery usually mean the fish need to be moved to another hatchery or released to the river. The real-time implementation of flow objectives and meeting SWRCB D-1641 Delta standards with the limited water resources of the Lower American River requires a significant coordination effort to manage the cold water resources at Folsom Dam and Reservoir. Reclamation consults with USFWS, NMFS, and CDFW through (b)(2)IT when these types of difficult decisions are needed. In addition, Reclamation communicates with the ARG on real-time data and operational tradeoffs.

A fish diversion weir at the hatcheries blocks Chinook Salmon from continuing upstream and guides them to the hatchery fish ladder entrance. The fish diversion weir consists of eight piers on 30-foot spacing, including two riverbank abutments. Fish rack support frames and walkways are installed each fall using an overhead cable system. A pipe rack is then put in place to support the pipe pickets (0.75-inch steel rods spaced on 2.5-inch centers). The pipe rack rests on a submerged steel I-beam support frame that extends between the piers and forms the upper support structure for a rock-filled crib foundation. The rock foundation has deteriorated with age and is subject to annual scour, which can leave holes in the foundation that allow fish to pass if left unattended. Reclamation released the final environmental documentation in August 2011 that selected an alternative to extend the existing fishway up to Nimbus Dam as the solution to the issues associated with the weir. Construction of the new fishway is expected to be completed by 2030.

Fish rack supports and pickets are installed during early to mid-September of each year to correspond with the beginning of the fall-run Chinook Salmon spawning season. A release equal to or less than 1,500 cfs from Nimbus Dam is required for safety and to provide full access to the fish rack supports. It takes six people approximately 3 days to install the fish rack supports and pickets. In years after high winter flows have caused active scour of the rock foundation, a short period (less than 8 hours) of lower flow (approximately 500 cfs) is needed to remove debris from the I-beam support frames, seat the pipe racks, and fill holes in the rock foundation. Complete installation can take up to 7 days, but is generally completed in less time. The fish rack supports and pickets are usually removed at the end of fall-run Chinook Salmon spawning season (mid-January) when flows are less than 2,000 cfs. If Nimbus Dam releases are expected to exceed 5,000 cfs during the operational period, the pipe pickets are removed until flows decrease.

As described previously, Folsom Reservoir also is operated to release water to meet Delta water quality and flow objectives to improve fisheries conditions, including releases for salinity objectives. Weather conditions combined with tidal action can quickly affect Delta salinity conditions, and therefore, the Delta outflow required to maintain joint standards. If, in this circumstance, it is decided the reasonable course of action is to increase upstream reservoir releases, then the response would likely be to increase Folsom Reservoir releases first because the released water would reach the Delta before flows released from other CVP and SWP reservoirs. Lake Oroville water releases require about 3 days to reach the

Delta, while water released from Shasta Lake requires 5 days to travel from Keswick Reservoir to the Delta. As water from the other reservoirs arrives in the Delta, Folsom Reservoir releases can be adjusted downward. These operational practices can reduce the amount of water in Folsom Reservoir, especially during a water year with limited snowpack. The water released from Folsom Reservoir cannot be replaced during the late winter and spring months if the snowpack is not adequate. When these conditions occur, there is a possibility of reduced water deliveries to CVP water service contractors that rely solely upon American River water supplies, including El Dorado County Water Agency, El Dorado Irrigation District, Sacramento Municipal Utility District, cities of Roseville and Folsom, PCWA, San Juan Water District, and Sacramento County Water Agency.

3A.4.3.3.3 CVPIA 3406 (b)(2) Operations on the Lower American River

Dedication of (b)(2) water on the American River provides instream flows below Nimbus Dam greater than those that would have occurred under pre-CVPIA regulations, e.g., the fish and wildlife requirements previously mentioned in the American River Division. Instream flow objectives from October through May generally aim to provide suitable habitat for salmon and steelhead spawning, incubation, and rearing, while considering impacts. Instream flow objectives for June to September endeavor to provide suitable flows and water temperatures for juvenile steelhead rearing, while balancing the effects on temperature operations into October and November.

Flow Fluctuation and Stability Concerns

Through CVPIA, Reclamation has funded studies by CDFW to better define the relationships of Nimbus release rates and rates of change criteria in the Lower American River to minimize the negative effects of necessary Nimbus release changes on sensitive fishery objectives. Reclamation is presently using draft criteria developed by CDFW. The draft criteria have helped reduce the incidence of anadromous fish stranding relative to past historic operations.

The primary operational coordination for potentially sensitive Nimbus Dam release changes is conducted through the (b)(2)IT process. The ARG is another forum to discuss criteria for flow fluctuations. Since 1996 the group has provided input on a number of operational issues and has served as an aid towards adaptively managing releases, including flow fluctuation and stability, and managing water temperatures in the Lower American River to meet the needs of salmon and steelhead.

3A.4.3.4 Delta Division and West San Joaquin Division

3A.4.3.4.1 CVP Facilities

The CVP's Delta Division consists of the DCC, the Contra Costa Canal and Pumping Plants, Contra Loma Dam, Martinez Dam, the Jones Pumping Plant (formerly Tracy Pumping Plant), the TFCF, and the DMC. Collectively these facilities divert water for irrigation and M&I use to the San Francisco Bay Area, the Central Valley, and for transport to Southern California. The DCC is a controlled diversion channel between the Sacramento River and Snodgrass Slough. The 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.

3A.4.3.4.2 Delta Cross Channel Operations

The DCC is a gated diversion channel in the Sacramento River near Walnut Grove and Snodgrass Slough. Flows into the DCC 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 DCC 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 DCC in the open position to (1) improve the movement of water 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.

Flow rates through the gates are determined by Sacramento River stage and are not affected by export rates in the south Delta. The DCC also serves as a link between the Mokelumne River and the Sacramento River for small craft, and is used extensively by recreational boaters and fishermen whenever it is open. Because alternative routes around the DCC are quite long, Reclamation tries to provide adequate notice of DCC closures so boaters may plan for the longer excursion.

SWRCB D-1641 DCC standards provide for closure of the DCC gates for fisheries protection at certain times of the year. From November through January, the DCC 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 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. These discussions occur through WOMT as part of the weekly review of CVP and SWP operations.

WOMT typically relies on monitoring for fish presence and movement in the Sacramento River and Delta, the salvage of salmon at the Tracy and Skinner facilities, and hydrologic cues when considering the timing of DCC closures. However, the overriding factors are current water quality conditions in the interior and western Delta. From mid-June to November, Reclamation usually keeps the gates open on a continuous basis. The DCC is also usually opened for the busy recreational Memorial Day weekend, if this is possible from a fishery, water quality, and flow standpoint.

The Salmon Decision Process is used by the fishery agencies and Project operators to facilitate the often complex coordination issues surrounding DCC gate operations and the purposes of fishery protection closures, Delta water quality, and/or export reductions. Inputs such as fish life stage and size development, current hydrologic events, fish indicators (such as the Knight's Landing Catch Index and Sacramento Catch Index), and salvage at the export facilities, as well as current and projected Delta water quality conditions, are used to determine potential DCC closures and/or export reductions. The Salmon Decision Process includes "Indicators of Sensitive Periods for Salmon," such as hydrologic changes, detection of spring-run salmon or spring-run salmon surrogates at monitoring sites or the salvage facilities, and turbidity increases at monitoring sites, which trigger the Salmon Decision Process.

Implementation of 2009 National Marine Fisheries Service Biological Opinion

The 2009 NMFS BO RPA Action IV.1.2 requires Reclamation to close the DCC for additional days from October 1 through November 30; December 1 through December 14, unless closures cause adverse impacts on water quality conditions; and December 15 through January 31, if fish are present.

3A.4.3.4.3 Jones Pumping Plant

The CVP and SWP use the Sacramento River, San Joaquin River, and Delta channels to transport water to export pumping plants located in the south Delta. The CVP's Jones Pumping Plant, located about 5 miles north of Tracy, has six available pumps. The Jones Pumping Plant has a permitted diversion capacity of 4,600 cfs and sits at the end of an earth-lined intake channel about 2.5 miles long. With the completion of the Delta-Mendota Canal/California Aqueduct Intertie (described under Joint Project Facilities), this capacity is no longer limited. At the head of the intake channel, louver screens (that are part of the TFCF) intercept fish, which are then collected, held, and transported by tanker truck to release sites far away from the pumping plants. The CVP uses two release sites, one on the Sacramento River near Horseshoe Bend and the other on the San Joaquin River immediately upstream of the Antioch Bridge.

3A.4.3.4.4 Tracy Fish Collection Facility

The TFCF is located in the south-west portion of the Delta and uses behavioral barriers consisting of primary and secondary louvers, to guide entrained fish into holding tanks before transport by truck to release sites within the Delta. The TFCF was designed to handle smaller fish (<200 millimeters [mm]) that would have difficulty fighting the strong pumping plant induced flows since the intake is essentially open to the Delta and also impacted by tidal action.

The primary louvers are located in the primary channel just downstream of the trashrack structure. The secondary louvers are located in the secondary channel just downstream of the traveling water screen. The louvers allow water to pass through onto the pumping plant but the openings between the slats are tight enough and angled against the flow of water so as to prevent most fish from passing between them and instead enter one of four bypass entrances along the louver arrays.

Approximately 52 different species of fish are entrained into the TFCF each year; however, the total numbers are significantly different for the various species salvaged. Also, it is difficult if not impossible to determine exactly how many safely make it all the way to the collection tanks, to be transported back to the Delta. Hauling trucks used to transport salvaged fish to release sites inject oxygen and contain an eight parts per thousand salt solution to reduce stress.

When south Delta hydraulic conditions allow, and within the original design criteria for the TFCF, the louvers are operated with the D-1485 objectives of achieving water approach velocities: for striped bass of approximately 1 foot per second (ft/s) from May 15 through October 31, and for salmon of approximately 3 feet/second (ft/s) from November 1 through May 14.

Fish passing through the facility are sampled at intervals of no less than 20 minutes every 2 hours when listed fish are present, generally December through June. When few fish are present, sampling intervals are 10 minutes every 2 hours. Fish observed during sampling intervals are identified by species, measured to fork length, examined for marks or tags, and placed in the collection facilities for transport by tanker truck to the release sites in the North Delta away from the pumps. In addition, TFCF personnel monitor for the presence of spent female Delta Smelt in anticipation of expanding the salvage operations to include sub-20 millimeter (mm) larval Delta Smelt detection.

CDFW is leading studies of fish survival during the collection, handling, transportation, and release process, examining Delta Smelt injury, stress, survival, and predation. Thus far it has presented initial findings at various interagency meetings (Interagency Ecological Program [IEP], Central Valley Fish Facilities Review Team, and American Fisheries Society) showing relatively high survival and low injury. DWR has concurrently been conducting focused studies examining the release phase of the salvage process including a study examining predation at the point of release and a study examining injury and survival of Delta Smelt and Chinook Salmon through the release pipe. Based on these studies, improvements to release operations and/or facilities, including improving fishing opportunities in Clifton Court Forebay (CCF) to reduce populations of predator fish, are being implemented.

CDFW and USFWS evaluated pre-screen loss and facility/louver efficiency for juvenile and adult Delta Smelt at the Skinner Fish Facility of the SWP (described in Section 5, State Water Project). DWR also conducted pre-screen loss and facility efficiency studies for steelhead.

3A.4.3.4.5 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 SWRCB. CCWD's 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. Reclamation completed construction of a fish screen at the Rock Slough intake in 2011; testing and the transfer of operation and maintenance of the fish screen to CCWD is ongoing. 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 26,780 acre-feet 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 CCWD's Contra Costa Canal Encasement Project to be completed. When fully completed, the Canal Encasement Project would eliminate tidal flows into the Canal because the encased pipeline would be located below the tidal range elevation. Pumping Plant 1 has capacity to pump up to 350 cfs into the concrete-lined portion of the Canal. Diversions at Rock Slough Intake are typically taken under CVP contract. CCWD may divert approximately 30 percent to 50 percent of its total supply through the Rock Slough Intake depending upon water quality there.

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 BOs and by SWRCB Decision 1629, SWRCB water right decision for the Los Vaqueros Project (Permit 20749). Diversions to storage in Los Vaqueros Reservoir are typically taken under CVP contract or under the Los Vaqueros water right permit. The CCWD's water diversions that are not made at Rock Slough diverted at the Middle River and Old River intakes, as determined primarily by the CCWD water quality goals, described below.

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, 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 either to pump to the Contra Costa Canal or to fill the 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). The effects of the Middle River Intake on Delta Smelt are covered by the April 27, 2007 USFWS BO (amended on May 16, 2007). Effects on salmonids and Green Sturgeon are covered by the July 13, 2007 NMFS BO for this intake project.

CCWD operates the Middle River Intake together with its other intake facilities to meet its delivered water quality goals and to protect listed species. The choice of which intake to use at any given time is based in large part upon salinity at the intakes, consistent with fish protection requirements in the BOs for the Middle River Intake and the Los Vaqueros Project. The Middle River Intake was built as a project to improve the water quality delivered to the CCWD service area, and does not increase CCWD's average annual diversions from the Delta. However, it can alter the timing and pattern of CCWD's diversions, because Middle River Intake salinity tends to be lower in the late summer and fall than salinity at CCWD's other intakes. This allows CCWD to decrease winter and spring diversions while still meeting water quality goals in the summer and fall through use of the new intake.

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.

CCWD diverts approximately 127 TAF per year in total. Approximately 110 TAF is CVP contract supply. In winter and spring months when the Delta is relatively fresh (generally January through July), deliveries to the CCWD service area are made by direct diversion from the Delta. In addition, when salinity is low enough, Los Vaqueros Reservoir is filled at a rate of up to 200 cfs from the Old River Intake and Middle River Intake. The BOs for the Los Vaqueros Project, CCWD's Incidental Take Permit issued by CDFW, and SWRCB D-1629 include fisheries protection measures consisting of a 75-day period during which CCWD does not fill Los Vaqueros Reservoir and a concurrent 30-day period during which CCWD halts all diversions from the Delta, provided that Los Vaqueros Reservoir storage is above emergency levels. The default dates for the no-fill and no-diversion periods are March 15 through May 31 and April 1 through April 30, respectively. USFWS, NMFS, and CDFW can change these dates to best protect the subject species. CCWD coordinates the filling of Los Vaqueros Reservoir with Reclamation and DWR to avoid water supply impacts on other CVP and SWP customers. During the no-diversion period, CCWD customer demand is met by releases from Los Vaqueros Reservoir.

In addition to the existing 75-day no-fill period (March 15 to May 31) and the concurrent no-diversion 30 day period, CCWD operates to an additional term in the Incidental Take Permit issued by CDFW. Under this term, CCWD shall not divert water to storage in Los Vaqueros Reservoir for 15 days from February 14 through February 28, provided that reservoir storage is at or above 90 TAF on February 1. If reservoir storage is at or above 80 TAF on February 1, but below 90 TAF, CCWD shall not divert water to storage in Los Vaqueros Reservoir for 10 days from February 19 through February 28. If reservoir storage is at or above 70 TAF on February 1, but below 80 TAF, CCWD shall not divert water to storage in Los Vaqueros Reservoir for 5 days from February 24 through February 28. These dates can be changed to better protect Delta fish species, at the direction of CDFW.

CCWD's operation of the diversion, storage, and conveyance facilities to divert water under CCWD's water rights meets the permitting requirements of the ESA through BOs issued by USFWS and NMFS that are specific to the CCWD system. The NMFS BO issued on March 18, 1993 and USFWS BO issued on September 9, 1993 address the operation of the Los Vaqueros Project, including the Los Vaqueros Reservoir and the Mallard Slough, Rock Slough, and Old River intakes. NMFS BO 2005/00122 issued on July 13, 2007, and USFWS BO issued on April 27, 2007 and amended on May 16, 2007, address the Middle River Intake operations. Concurrence that expansion of Los Vaqueros Reservoir to 160 TAF is not likely to adversely affect listed Delta fish species was provided by NMFS on October 15, 2010 and USFWS on November 1, 2010.

3A.4.3.4.6 Water Demands—Delta Mendota Canal and San Luis Unit

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. Distinct relationships exists between Reclamation and each of these three groups. Exchange contractors “exchanged” their senior rights to water in the San Joaquin River for a CVP water supply generally provided from the Delta. Reclamation thus guaranteed the exchange contractors a firm water supply from the Delta or the San Joaquin River of 840 TAF per annum, with a maximum reduction under the Shasta critical year criteria to an annual water supply of 650 TAF.

Conversely, water service contractors do not have water rights senior to CVP. Agricultural water service contractors also receive their supply from the Delta, but their supplies are subject to the availability of CVP water supplies that can be developed and reductions in contractual supply can be as high as 100 percent. The CVP also contracts with refuges to provide water supplies to specific managed lands for wildlife purposes. These contracts may be reduced under Shasta critical year criteria up to 25 percent.

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 demands because of reductions in CVP water supplies due to restricted Delta pumping capability. In some dry or critically dry years, water deliveries are limited because there is insufficient storage in northern CVP reservoirs to meet all instream fishery objectives, 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 to meet those demands, is a CVP operational objective that is intertwined with the Trinity, Sacramento, and American River operations.

3A.4.3.4.7 CVPIA 3406 (b)(2) Operations in the Delta

Export curtailments at the CVP Jones Pumping Plant and increased CVP reservoir releases required to meet SWRCB D-1641, as well as direct export reductions for fishery management using dedicated (b)(2) water at the CVP Jones Pumping Plant, is determined in accordance with the Interior Decision on Implementation of Section 3406 (b)(2) of the CVPIA. Direct Jones Pumping Plant export curtailments for fishery management protection is based on coordination with the weekly (b)(2)IT meetings and vetted through WOMT, as necessary.

3A.4.3.4.8 Implementation of 2008 USFWS and 2009 NMFS Biological Opinions

The 2008 USFWS BO and the 2009 NMFS BO restrict CVP and SWP diversions to reduce reverse flows in Old and Middle rivers (OMR). The 2008 USFWS BO also includes criteria for fall Delta outflow. The 2009 NMFS BO includes criteria for a San Joaquin River I:E ratio (Action IV.2.1), and additional criteria for closure of the Delta Cross Channel Gates.

2008 USFWS BO OMR Criteria

The 2008 USFWS BO limits reverse OMR flows as prescribed in the following three actions.

- Action 1: to protect adult Delta Smelt migration and entrainment. Limits exports so that the average daily OMR flow is no more negative than -2,000 cfs for a total duration of 14 days, with a 5-day running average no more negative than -2,500 cfs (within 25 percent).
  - December 1 to December 20 – Based upon turbidity data from turbidity stations (Prisoner's Point, Holland Cut, and Victoria Canal) and salvage data from CVP and SWP fish handling facilities at the south Delta intakes, and other parameters important to the protection of Delta Smelt including, but not limited to, preceding conditions of X2, Fall Midwater Trawl (FMWT) Survey, and river flows.
  - After December 20 – The action would begin if the 3 day average turbidity at Prisoner's Point, Holland Cut, and Victoria Canal exceeds 12 nephelometric turbidity units (NTU).
  - Triggers are based on:
    - Three-day average of 12 NTU or greater at all three turbidity stations; or
    - Three days of Delta Smelt salvage after December 20 at either facility or cumulative daily salvage count that is above a risk threshold based upon the "daily salvage index" approach reflected in a daily salvage index value of greater than or equal to 0.5 (daily Delta Smelt salvage is greater than one-half prior year FMWT index value). The window for triggering Action 1 concludes when either off-ramp condition described below is met. These off-ramp conditions may occur without Action 1 ever being triggered. If this occurs, then Action 3 is triggered, unless the Service concludes on the basis of the totality of available information that Action 2 should be implemented instead.
  - Action 1 offramps when water temperature reaches 12 degrees Celsius (°C) based on a three station daily mean at the temperature stations: Mossdale, Antioch, and Rio Vista; or the onset of spawning based upon the presence of spent females in the Spring Kodiak Trawl Survey or at the CVP or SWP fish handling facilities.

- Action 2: to protect adult Delta Smelt migration and entrainment. An action implemented using an adaptive process to tailor protection to changing environmental conditions after Action 1. As in Action 1, the intent is to protect pre-spawning adults from entrainment and, to the extent possible, from adverse hydrodynamic conditions. The range of net daily OMR flows would be no more negative than -1,250 to -5,000 cfs. Depending on extant conditions, specific OMR flows within this range are recommended by the USFWS Smelt Working Group (SWG) from the onset of Action 2 through its termination. The SWG would provide weekly recommendations based upon review of the sampling data, from real-time salvage data at the CVP and SWP, and utilizing most up-to-date technological expertise and knowledge relating population status and predicted distribution to monitored physical variables of flow and turbidity. The USFWS makes the final determination.
  - Action 2 begins immediately following Action 1. If Action 1 is not implemented based upon triggers, the SWG may recommend a start date for Action 2.
  - Action 2 is suspended when whenever a 3-day flow average is greater than or equal to 90,000 cfs in Sacramento River at Rio Vista and 10,000 cfs in San Joaquin River at Vernalis. Once such flows have abated, the OMR flow requirements of Action 2 are restarted.
  - Offramps for Action 2 are related to water temperature reaches 12°C based on a three-station daily average at the temperature stations: Rio Vista, Antioch, and Mossdale; or the onset of spawning based upon the presence of a spent female in the Spring Kodiak Trawl Survey or at the CVP or SWP fish handling facilities.
- Action 3: to protect larval and juvenile Delta Smelt. Minimize the number of larval Delta Smelt entrained at the facilities by managing the hydrodynamics in the Central Delta flow levels pumping rates spanning a time sufficient for protection of larval Delta Smelt. Net daily OMR flow would be no more negative than -1,250 to -5,000 cfs based on a 14-day running average with a simultaneous 5-day running average within 25 percent of the applicable requirement for OMR. Depending on extant conditions, specific OMR flows within this range are recommended by the SWG from the onset of Action 3 through its termination.
  - Action 3 begins when temperature reaches 12°C based on a three-station average at the temperature stations: Mossdale, Antioch, and Rio Vista; or onset of spawning based upon the presence of a spent female in the Spring Kodiak Trawl Survey or at the CVP or SWP fish handling facilities.
  - Action 3 offramps by June 30; or if water temperature reaches a daily average of 25°C for three consecutive days 10 at Clifton Court Forebay.

2009 NMFS BO OMR Criteria

The 2009 NMFS BO includes OMR criteria (Action IV.2.3) to protect juvenile salmonids during winter and spring emigration downstream into the San Joaquin River, and to increase survival of salmonids and Green Sturgeon entering the San Joaquin River from Georgiana Slough and the lower Mokelumne River by reducing the potential for entrainment at the south Delta intakes. The action is implemented from January 1 through June 15 to limit negative flows to -2,500 to -5,000 cfs in Old and Middle Rivers, depending on the presence of salmonids. The reverse flow would be managed within this range to reduce flows toward the pumps during periods of increased salmonid presence. The negative flow objective within the range shall be determine based on the following decision tree:

Date	Action Triggers	Action Responses
January 1 – June 15	January 1 – June 15	-5,000 cfs
January 1 – June 15 First Stage Trigger (increasing level of concern)	Daily SWP/CVP older juvenile loss density (fish per TAF) 1) is greater than incidental take limit divided by 2000, with a minimum value of 2.5 fish per TAF, or 2) daily loss is greater than daily measured fish density divided by 12 TAF, or 3) Coleman National Fish Hatchery coded wire tag late-fall run or Livingston Stone National Fish Hatchery coded wire tag winter-run cumulative loss greater than 0.5%, or 4) daily loss of wild steelhead (intact adipose fin) is greater than the daily measured fish density divided by 12 TAF.	-3,500 cfs for minimum of 5 days; and up to -5,000 cfs other times
January 1 – June 15 Second Stage Trigger (analogous to high concern level)	Daily SWP/CVP older juvenile loss density (fish per TAF) is 1) greater than incidental take limit divided by 1000, with a minimum value of 2.5 fish per TAF, or 2) daily loss is greater than daily fish density divided by 8 TAF, or 3) Coleman National Fish Hatchery coded wire tag late-fall run or Livingston Stone National Fish Hatchery coded wire tag winter-run cumulative loss greater than 0.5%, or 4) daily loss of wild steelhead (intact adipose fin) is greater than the daily measured fish density divided by 8 TAF.	-2,500 cfs for minimum of 5 days; and up to -5,000 cfs other times
End of Triggers	Continue action until June 15 or until average daily water temperature at Mossdale is greater than 72°F (22°C) for 7 consecutive days (1 week), whichever is earlier.	No OMR restriction.

2009 NMFS BO San Joaquin River Inflow:Export Ratio

The 2009 NMFS BO Action IV.2.1 requires south Delta exports to be reduced during April and May to protect emigrating steelhead from the lower San Joaquin River into the south Delta channels and intakes. The inflow:export ratio from April 1 through May 31 specifies that Reclamation operates the New Melones Reservoir to maintain the 2009 NMFS BO flow schedule for the Stanislaus River at Goodwin in accordance with Action III.1.3 and Appendix 2-E of the BO. In addition, the CVP and SWP pumps are operated to meet the following ratios, based upon a 14-day running average.

San Joaquin Valley Classification	San Joaquin River flow at Vernalis (cfs):CVP and SWP combined export ratio (cfs)
Critically dry	1:1
Dry	2:1
Below normal	3:1
Above normal	4:1
Wet	4:1
Vernalis flow equal to or greater than 21,750 cfs	Unrestricted exports until flood recedes below 21,750 cfs.

During multiple dry years, the ratio would be limited to 1:1 if the New Melones Index related to storage is less than 1,000 TAF and the sum s of the "indicator" numbers established for water year classifications in SWRCB D-1641 (based on the San Joaquin Valley 60-20-20 Water Year Classification in SWRCB D-1641) is greater than 6 for the past two years and the current year. The indicator numbers are 1 for a critically dry year, 2 for a dry year, 3 for a below normal year, 4 for an above normal year, and 5 for a wet year.

Implementation of the inflow:export ratio under all conditions would allow a minimum pumping rate of 1,500 cfs to meet public health and safety needs of communities that solely rely upon water diverted from the CVP and SWP pumping plants.

2008 USFWS BO Fall X2 Criteria

The 2008 USFWS BO also includes an additional Delta salinity requirement in September through November in wet and above normal water years (Action 4). This requirement is frequently referred to as "Fall X2." The action requires that in September and October, 2 Practical Salinity Units (psu) salinity is maintained at 74 kilometers (km) during wet years, and 81 km during above normal water years when the preceding year was wet or above normal based upon the Sacramento Basin 40-30-30 index in the SWRCB D-1641. In November of these years, there is no specific X2 requirement, however there is a requirement that all inflow into SWP and CVP upstream reservoirs be conveyed downstream to augment delta outflow to maintain X2 at the locations in September and October. If storage increases during November under this action, the increased storage volume is to be released in December in addition to the requirements under SWRCB D-1641 net Delta Outflow Index.

3A.4.3.5 East Side Division

The East Side Division encompasses the Stanislaus and San Joaquin River Systems and includes New Melones Dam, Tulloch Dam, Goodwin Dam, and smaller Diversion Dams and associated Reservoirs.

3A.4.3.5.1 Factors Influencing New Melones Operations

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 from March through early July contributes the largest portion of the flows in the Stanislaus River, with the highest runoff occurring in the months of April, May, and June. New Melones Reservoir is located approximately 60 miles upstream from the confluence of the Stanislaus River and the San Joaquin River.

Water Development Prior to Federal Actions

Agricultural water supply development in the Stanislaus River watershed began in the 1850s and has significantly altered the basin's hydrologic conditions. Prior to 1856, the San Joaquin Water Company constructed a diversion dam on the Stanislaus River immediately downstream of the present day location of Tulloch Dam and used the diversion dam to distribute water for irrigation and other uses in the Knights Ferry Area. Beginning in 1856, a series of water and power companies constructed several water supply and power facilities in the Stanislaus River watershed.

The San Joaquin Water Company was sold to the Tulloch family in the late 1800s, and in 1910, Oakdale Irrigation District (OID) and South San Joaquin Irrigation District (SSJID) bought the Tulloch water rights and physical distribution system. In 1913, OID and SSJID jointly constructed Goodwin Diversion Dam, an 80-foot tall double concrete arch dam, to divert Stanislaus River water (up to 1,816.6 cfs daily) into their respective canals for distribution into their respective service areas for irrigation. Despite its height, Goodwin Diversion Dam is a re-operating reservoir, not a storage reservoir, because a full reservoir is needed to allow diversion to these canals.

To address their lack of storage, OID and SSJID joined with The Pacific Gas and Electric Company (PG&E) in 1925 to construct the Melones Dam and Powerhouse (110 TAF capacity) approximately 12.3 river miles upstream of the Goodwin Diversion Dam. Water released from Melones was diverted at Goodwin Diversion Dam for delivery into OID and SSJID's distribution systems.

In 1955, OID and SSJID agreed to construct three new facilities, including the Donnells Dam and Reservoir (64,500 TAF capacity) and Beardsley Dam and Reservoir (97.5 TAF capacity) upstream of Melones Dam, and the Tulloch Dam and Reservoir (54.663 TAF capacity), downstream of Melones Dam.

Construction of the three facilities, collectively referred to as the Tri-Dam Project, was completed in 1957 and the facilities became operational in 1958. As part of the construction of the Tri-Dam project, Goodwin Diversion Dam was raised to create an afterbay to regulate discharge from Tulloch. From 1985–1990, the Calaveras County Water District constructed the North Fork Stanislaus Hydroelectric Project, which included the construction of New Spicer Reservoir (189 TAF capacity) in 1989. This was a joint development project by Northern California Power Agency (NCPA) and Calaveras County Water District. Calaveras County Water District is the licensee and NCPA is the project operator.

Twenty ungauged tributaries contribute flow to the lower portion of the Stanislaus River below Goodwin Dam. These streams provide intermittent flows, occurring primarily during the months of November through April. Agricultural return flows, as well as operational spills from irrigation canals receiving water from both the Stanislaus and Tuolumne Rivers, enter the lower portion of the Stanislaus River. In addition, a portion of the flow in the lower reach of the Stanislaus River originates from groundwater accretions. There are also approximately 48 TAF of annual riparian water rights in the Stanislaus River downstream of Goodwin Dam.

Federal Water Development

In the Flood Control Act of December 1944, Congress authorized construction of a dam to replace Melones Dam to help alleviate serious flooding problems along the Stanislaus and Lower San Joaquin Rivers. In the Flood Control Act of October 1962, Congress reauthorized the project, and expanded it to be a multipurpose facility to be built by USACE and operated by the Secretary of the Interior as the New Melones Unit of the Eastside Division of the CVP. Dam and reservoir construction began in 1966 and, after being halted from 1972 to 1974, was completed by USACE in 1978, with a storage capacity of 2.4 MAF.

In 1972, Reclamation applied for the assignment of two state-filed water rights and two new water rights for the New Melones Project. These applications were protested by several parties and mostly resolved through protest settlement agreements. In 1973, SWRCB Decision 1422 (D-1422) initially approved less than 600 TAF in storage for power, senior water rights, water quality, and fish and wildlife protection and enhancement, citing a lack of demonstrated demand and protection of upstream recreation as a reason not to grant consumptive use rights for new demands without further demonstration of a demand for this water.

To demonstrate the consumptive use demands, in 1980 Reclamation produced a Stanislaus River Water Allocation and an EIS for the proposed water allocation of the New Melones Unit. The documents describe preferred and alternative boundaries of the Stanislaus River Basin, the anticipated project yield for 2020 conditions, the current and anticipated future needs of such basin, the determination of an available “interim” supply until the full buildup of in-basin needs, and an anticipated “firm yield” once full in-basin demand was established. The ROD described that New Melones Reservoir would generate a water supply yield of 230 TAF in 2000, and 180 TAF in 2020; assuming maximum annual releases of 70 TAF for water quality and 98 TAF for downstream fishery. For the interim supply, 85 TAF would be available in the year 2000, diminishing to zero at full in-basin demand. For the firm supply, the Secretary determined that there would be 49 TAF available in 2020 after in-basin demands were met. In 1983, Reclamation entered into a long-term water service contract with Central San Joaquin Water Conservation District for 49 TAF of firm supply and an interim supply of 31 TAF, and a long-term water service contract totaling 75 TAF of interim water with Stockton East Water District (SEWD). Reclamation then successfully applied to have D-1422 amended to allow up to full storage for demonstrated power and consumptive use demands in the same year, and New Melones briefly filled to its capacity of 2.4 MAF for the first time.

In 1984, Reclamation applied for the assignment of the direct diversion portion of one of the state water right filings, to be able to serve contracts water at times when New Melones is filling. The application was again protested, with protests largely settled through protest settlement agreements. The direct diversion right was granted in D-1616 in 1988. D-1616 continued water quality requirements and included a new fish and wildlife protest settlement agreement. A later revision added a requirement to study downstream steelhead/trout needs.

In 1995 and in 2000, water rights decisions related to updates of the San Francisco Bay/Sacramento–San Joaquin River Delta Water Quality Control Plan (WQCP) added flow requirements at Vernalis and partial responsibility for interior Delta water quality to CVP water rights.

Flood Control

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. When possible, however, releases from Tulloch Dam are maintained at levels that would not result in long-term downstream flows in excess of 1,500 cfs because of the past reported potential for seepage in agricultural lands adjoining the river associated with flows above this level. Up to 450 TAF of the 2.4 MAF storage volume in New Melones Reservoir is dedicated for flood control and 10 TAF of Tulloch Reservoir storage is set aside for flood control. Based upon the flood control diagrams prepared by USACE, part or all of the dedicated flood control storage may be used for conservation storage (storing allocated, excess waters), depending on the time of year and the current flood hazard.

Current Water Rights Requirements for New Melones Operations

The operating criteria for New Melones Reservoir are constrained by water rights requirements, flood control operations, contractual obligations, and federal requirements under the ESA and CVPIA.

Terms and conditions of Reclamation's water rights define the limitations within which Reclamation can directly divert water or divert water to storage, after senior water rights and in-basin demands are met. Senior water rights are both current and future upstream water right holders (whose priority is reserved in D-1422 and D-1616 and through protest settlement agreements with Tuolumne and Calaveras Counties), and current downstream water right holders and riparian rights (whose priorities are either senior to Reclamation or senior to appropriative rights in general, respectively). In-basin, instream demands include water quality and flow in the lower Stanislaus River and in part in the lower San Joaquin River and Delta (in that the Stanislaus River contributes to these systems). Downstream demands are first met, to the degree possible, by bypassing natural inflow through New Melones Reservoir. When natural flow is insufficient, stored water is released to meet demands specified either through calculated riparian demand, downstream instream objectives, or protest settlement agreements. Whenever possible, multiple demands are met with the same flow.

Senior Water Rights: Protest Settlement Agreements

Reclamation's application for assignment of state water right filings in the early 1970s was protested by future in-basin users, senior water rights holders, and the CDFW. To resolve the senior water rights' protest, Reclamation entered into a 1972 Agreement and Stipulation with OID, and SSJID. The 1972 Agreement and Stipulation specifies that it satisfies the yield for consumptive purposes of the OID and SSJID water rights on the Stanislaus River, through the provision of up to a maximum of 654 TAF per year of either natural inflow to New Melones Reservoir or water stored in New Melones for diversion at Goodwin Dam for direct use by OID and SSJID and for storage in Woodward Reservoir (36 TAF capacity).

In 1988, following a year of low inflow to New Melones Reservoir, the Agreement and Stipulation among Reclamation, OID, and SSJID was renegotiated, resulting in an agreement that depended less on actual inflow and more on Reclamation's storage in New Melones, in order to provide a more reliable, albeit slightly smaller maximum, supply. The 1988 agreement commits Reclamation to provide water in accordance with a formula based on inflow and storage of up to 600 TAF each year for diversion at Goodwin Dam by OID and SSJID to meet their demands. The 1988 Agreement and Stipulation created a "conservation account" in which the difference between the entitled quantity and the actual quantity diverted by OID and SSJID in a year may be carried over for use in subsequent years, depending on storage/flood control conditions in New Melones. This conservation account has a maximum volume of 200 TAF, and withdrawals are constrained by criteria in the agreement.

In-Basin Requirements: Fish and Wildlife in the Lower Stanislaus River

Based on a protest settlement agreement between Reclamation and CDFW, SWRCB D-1422 required Reclamation to bypass or release 98 TAF of water per year (69 TAF in critical years) through New Melones Reservoir to the Stanislaus River on a distribution pattern to be specified each year by CDFW for fish and wildlife purposes. Based on a second protest settlement agreement in 1987, SWRCB D-1616 as amended required increased releases from New Melones to enhance fishery resources for an interim period, during which habitat requirements were to be better defined and a study of Chinook Salmon fisheries on the Stanislaus River would be completed.

During the study period, releases for instream flows were to range from 98.3 to 302.1 TAF per year. The exact quantity to be released each year was to be determined based on a formulation involving storage, projected inflows, projected water supply, water quality demands, projected CVP contractor demands, and target carryover storage. Because of dry hydrologic conditions during the 1987 to 1992 drought period, the ability to provide increased releases was limited. USFWS published the results of a 1993 study, which recommended a minimum instream flow on the Stanislaus River of 155.7 TAF per year for spawning and rearing (Aceituno 1993).

The study period is near completion with all but one study (outlined in the 1987 agreement) completed at the time of this document. Once this study period is completed, Reclamation is required to present the SWRCB with a revised plan of operations that incorporates the findings from the studies. This new plan is explained below and will replace the former CDFW downstream release requirements.

In-Basin Requirements: Fish and Wildlife in the Lower San Joaquin River

SWRCB D-1641 conditioned CVP water rights to meet flow requirements on the San Joaquin River at Vernalis from February to June to the extent possible. These flows are summarized in Table 3A.8.

Table 3A.8 San Joaquin Base Flows-Vernalis

Water Year Class	February–June Flow (cfs)*
Critical	710–1,140
Dry	1,420–2,280
Below Normal	1,420–2,280
Above Normal	2,130–3,420
Wet	2,130–3,420

*The higher flow required when X2 is required to be at or west of Chipps Island.

In-Basin Requirements: Water Quality in the Lower Stanislaus River

Reclamation's New Melones water rights require that water be bypassed through or released from New Melones Reservoir to maintain applicable dissolved oxygen (DO) standards to protect the salmon fishery in the Stanislaus River. The 2004 San Joaquin Basin 5C Plan (Central Valley Regional Water Quality Control Board) designates the lower Stanislaus River with cold water and spawning beneficial uses, which have a general water quality objective of no less than 7 mg/L DO. This objective is therefore applied through the water rights to the Stanislaus River near Ripon.

Although not part of the No Action Alternative, Reclamation is evaluating studies to support moving the DO compliance point upstream to Orange Blossom Bridge. The location would better correspond to steelhead rearing in the spring and summer months. If movement of the DO compliance point appears adequately protective, Reclamation would petition the SWRCB to modify New Melones water rights accordingly. The movement of the compliance point is considered in Alternative 3 in this EIS.

In-Basin Requirements: Water Quality in the Lower San Joaquin River

SWRCB D-1422 required Reclamation to operate New Melones to maintain average monthly levels of 500 parts per million (ppm) total dissolved solids (TDS) in the San Joaquin River at Vernalis as it enters the Delta. SWRCB D-1641 modified the water quality objectives at Vernalis to include the irrigation and non-irrigation season objectives contained in the 1995 WQCP: average monthly electric conductivity (EC) of 0.7 milliSiemens per centimeter (mS/cm) during the months of April through August and 1.0 mS/cm during the months of September through March.

1997 New Melones Interim Plan of Operations

In 1997, Reclamation developed the Interim Plan of Operations as a joint effort with USFWS and in conjunction with the Stanislaus River Basin Stakeholders (SRBS). The process of developing the plan began in 1995 with a goal to develop a long-term management plan with clear operating criteria, given a fundamental recognition by all parties that New Melones Reservoir water supplies are over-committed on a long-term basis, and consequently, unable to meet all the potential beneficial uses designated as purposes.

In 1996, the focus shifted to the development of an interim operations plan for 1997 and 1998. At an SRBS meeting on January 29, 1997, a final interim plan of operation was agreed to in concept. The Interim Plan of Operation (IPO) was transmitted to the SRBS on May 1, 1997. Although meant to be a short-term plan for non-low periods only, it continued to be the guiding operations criteria in effect for the annual planning to meet multiple beneficial uses from New Melones Reservoir storage. The plan limited released water based on the available water supply, known as the New Melones Index, as summarized in Tables 3A.9 and 3A.10.

Table 3A.9 Inflow/Storage Characterization for the New Melones IPO

Annual Water Supply Category	March–September Forecasted Inflow Plus End of February Storage (TAF)
Low	0–1,400
Medium-low	1,400–2,000
Medium	2,000–2,500
Medium-high	2,500–3,000
High	3,000–6,000

The IPO suggested available quantities for various categories of water supply based on storage and projected inflow, as summarized in Table 3A.10. The annual water categories are for in-stream fishery enhancement (1987 CDFW Agreement and CVPIA Section 3406(b)(2) management), SWRCB D-1641

San Joaquin River water quality requirements (Water Quality), SWRCB D-1641 Vernalis flow requirements (Bay-Delta), and use by CVP contractors.

Table 3A.10 New Melones Modified IPO Flow Objectives (in TAF)

Storage Plus Inflow		Fishery		Vernalis Water Quality		Bay-Delta		CVP Contractors	
From	To	From	To	From	To	From	To	From	To
1,400	2,000	98	125	70	80	0	0	0	0
2,000	2,500	125	345	80	175	0	0	0	59
2,500	3,000	345	467	175	250	75	75	90	90
3,000	6,000	467	467	250	250	75	75	90	90

Although SEWD/CSJWCD agreed to this plan for a 2-year period, they subsequently successfully litigated against Reclamation. As a consequence, Reclamation is now required to provide the full contract amount to the CVP contractors except during times of drought. This plan also assumed that the full responsibility of Vernalis objectives would fall to the Stanislaus River and New Melones Reservoir rather than be divided up among the other San Joaquin tributaries.

Water Temperatures

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, ambient air conditions, and residence time in Tulloch Reservoir, as affected by local irrigation demand.

CVPIA 3406 (b)(2) Operations on the Stanislaus River

2009 NMFS BO RPA flows described below are often accounted for dedication of (b)(2) water on the Stanislaus River below Goodwin Dam in addition to the CDFW requirements discussed previously in the East Side Division.

Implementation of 2009 National Marine Fisheries Service Biological Opinion

The 2009 NMFS BO RPA requires Reclamation to adaptively manage flows to meet minimum instream flow, ramping flow, pulse flow, floodplain inundation, and geomorphic and function flow patterns, through the following actions.

- Minimum base flows to optimize available steelhead habitat for adult migration, spawning, and juvenile rearing by water year type, as measured downstream of Goodwin Dam, as specified in Appendix 2-E of the 2009 NMFS BO RPA.
- Fall pulse flows to improve instream conditions.
- Winter instability flows to simulate natural variability in the winter hydrograph and to enhance access to varied rearing habitats.

- Channel forming and maintenance flows in the 3,000 to 5,000 cfs range in above normal and wet years to maintain spawning and rearing habitat quality after March 1 to protect incubating eggs and to provide outmigration flow cues and late spring flows.
- Outmigration flow cues to enhance likelihood of anadromy.
- Late spring flows for conveyance and maintenance of downstream migratory habitat quality in the lowest reaches and into the Delta.

Flows also are released to meet the following temperature requirements (see 2009 NMFS BO RPA for exception criteria) to protect steelhead.

- October 1 (or initiation of fall pulse flow) through December 31: 56° F at Orange Blossom Bridge
- January 1 through May 31: 52° F at Knights Ferry and below 55° F at Orange Blossom Bridge
- June 1 through September 30: 65° F at Orange Blossom Bridge

Reclamation also is required to evaluate an approach to operate New Melones Reservoir flow releases to achieve floodplain inundation flows and improved freshwater migratory habitat for steelhead.

3A.4.3.6 San Felipe Division

Construction of the San Felipe Division of the CVP was authorized in 1967. The San Felipe Division initiated operation in 1987 and provides a water supply 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 instream and offstream groundwater recharge operations conducted by local water users. 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. 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 water to about 19,700 arable acres.

The San Felipe Division facilities that serve Santa Clara and San Benito Counties include 54 miles of tunnels and conduits, two large pumping plants, and one reservoir (San Justo Reservoir in San Benito County). CVP water is conveyed from the Delta through the DMC, O'Neill Forebay, and San Luis Reservoir. A maximum of 480 cfs is lifted from San Luis Reservoir by the Pacheco Pumping Plant's twelve 2,000-horsepower pumps to a height varying from 85 to 300 feet into a regulating tank. Water flows from the regulating tank by gravity through the 5.2-mile long Pacheco Tunnel and 7.9-mile long Pacheco Conduit. The

Pacheco Conduit terminates at a bifurcation structure, where the water is conveyed into Santa Clara and San Benito Counties.

In Santa Clara County, water flows from the bifurcation structure into the 1-mile long Santa Clara Tunnel. Water flows by gravity from the tunnel into a 20-mile long Santa Clara Conduit to the Coyote Pumping Plant for distribution of CVP water within Santa Clara County. In San Benito County, water flows from the bifurcation structure to the 19.1-mile long Hollister Conduit with a maximum capacity of approximately 93 cfs, terminating at the San Justo Reservoir.

Santa Clara Valley Water District operates the San Felipe Division facilities except for the Hollister Conduit and San Justo Reservoir, which are operated by San Benito County Water District under operating agreements with Reclamation.

The 9.906 TAF-capacity San Justo Reservoir is located about 3 miles southwest of the city of Hollister. The San Justo Dam is an earthfill structure 141 feet high with a crest length of 722 feet. This facility includes a dike structure 66 feet high with a crest length of 918 feet. This reservoir regulates San Benito County Water District's CVP water supplies, allows pressure deliveries to some of the agricultural lands in the service area, and provides storage for peaking of agricultural water.

3A.4.3.7 Friant Division

As described previously, Friant Division operations are not analyzed in this EIS. The information included below provides an understanding of how the Friant Division operations affect CVP and SWP operations.

Historically, this division was hydrologically disconnected from the rest of the CVP except in very wet years and was not integrated into the CVP Operations Criteria and Plan (OCAP). Friant Dam is located on the San Joaquin River, 25 miles northeast of Fresno where the San Joaquin River exits the Sierra Nevada foothills and enters the Central Valley. The drainage basin is 1,676 square miles with an average annual runoff of 1,774 TAF. 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 reservoir, Millerton Lake, first stored water on February 21, 1944. It has a total capacity of 524 TAF, 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.

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 Irrigation Districts. A minimum of 5 cfs is required to pass the last water right holding located about 40 miles downstream of Friant Dam near

Gravelly Ford. Before October 1, 2009, and the initiation of Interim Flows for the San Joaquin River Restoration Program (SJRRP), the Friant Division was generally hydrologically disconnected from the Delta. The San Joaquin River was dewatered in two reaches between Friant Dam and the confluence of the Merced River, except under flood conditions.

Flood control storage space in Millerton Lake is based on a complex formula, which considers upstream storage in the Southern California Edison reservoirs, forecasted snowmelt, and time of year. Flood management releases occur approximately every 3 years and are managed based on downstream channel design flow of approximately 8,000 cfs, to the extent possible. Under flood conditions, water is diverted into two bypass channels that carry flood flows to near the confluence of the Merced River. Flows staying in the mainstem are diverted into the Mendota Pool, and may be used to meet irrigation demands there.

3A.4.3.8 San Joaquin River Restoration Program

In 2006, parties to *NRDC, et al., v. Rodgers, et al.*, executed a stipulation of settlement that called for a comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of the Merced River and a self-sustaining Chinook Salmon fishery while reducing or avoiding adverse water supply impacts. The SJRRP implements the Settlement consistent with the San Joaquin River Restoration Settlement Act in Public Law 111-11. Consultation with NMFS and USFWS under the ESA on implementation of the Settlement has occurred as part of the SJRRP and would continue to occur to evaluate the effects of implementation of settlement actions on listed species. USFWS issued a Programmatic BO (PBO) for the implementation of the SJRRP on August 21, 2012 and NMFS issued a PBO on September 18, 2012. The programmatic Biological Opinions include project-level consultation for SJRRP flow releases of up to 1,660 cfs from Friant Dam down the San Joaquin River. Programmatic ESA coverage is provided in both the USFWS and NMFS PBOs for flow releases from Friant Dam up to 4,500 cfs and all physical restoration and water management actions listed in the Settlement. Future flow increases from Friant Dam in excess of 1,660 cfs for the SJRRP would need to be coordinated and consulted on with the appropriate regulatory agencies to ensure ESA compliance.

The Settlement-required flow targets for releases from Friant Dam include six water year types for releases depending upon available water supply as measures of inflow to Millerton Lake. The releases from Friant Dam include the flexibility to reshape and retime releases forwards or backwards by 4 weeks during the spring and fall pulse periods. Flood flows may potentially occur and meet or exceed the Settlement flow targets. If flood flows meet the Settlement flow targets, then Reclamation would not release additional water. The San Joaquin River channel downstream of Friant Dam currently lacks the capacity to convey flows to the Merced River and releases are limited accordingly. Reclamation has initiated planning and environmental compliance activities to improve river channel conveyance and allow for the full release of SJRRP flows. Diversions and infiltration losses reduce the amount of Settlement flows reaching the San Joaquin and Merced River confluence. Flows that reach the Merced confluence are assumed to continue to the Delta.

3A.5 State Water Project

DWR holds contracts with 29 public agencies in Northern, Central, and Southern California for water supplies from the SWP. Water stored in the Lake Oroville facilities, along with excess water available in the Delta, is captured in the Delta and conveyed through several facilities to SWP water contractors.

The SWP is operated to provide flood control and water for agricultural, M&I, recreational, and environmental purposes. Water is conserved in Lake Oroville and released to serve three Feather River area water contractors and two water contractors served from the NBA, and 24 SWP contractors in the SWP service areas in the south San Francisco Bay Area, San Joaquin Valley, and Southern California. In addition to pumping water released from Lake Oroville, the Banks Pumping Plant diverts natural inflow available in the Delta.

3A.5.1 Project Management Objectives

The SWP is managed to maximize the capture of usable Delta supplies released from Lake Oroville storage as well as surplus supplies available in the Delta. The maximum daily pumping rate at Banks Pumping Plant is controlled by a combination of SWRCB D-1641, the requirements contained in the BOs, the adaptive management process, and permits issued by USACE that regulate the rate of diversion of water into CCF for pumping at Banks Pumping Plant. This diversion rate is normally restricted to 6,680 cfs as a 3-day average inflow to CCF and 6,993 cfs as a 1-day average inflow to CCF. CCF diversions may be greater than these rates between December 15 and March 15, when the inflow into CCF may be augmented by one-third of the San Joaquin River flow at Vernalis when those flows are equal to or greater than 1,000 cfs. Additionally, the SWP has a permit to export an additional 500 cfs between July 1 and September 30 based upon on Project losses for same water year to protect listed fish.

The CCF radial gates are closed during critical periods of the ebb/flood tidal cycle to protect water levels relied upon by local agricultural water diverters in the south Delta area.

Banks Pumping Plant is operated to minimize the impact on power loads on the California electrical grid to the extent practical, using CCF as a holding reservoir to allow that flexibility. Generally more pump units are operated during off-peak periods and fewer during peak periods. Because the installed capacity of the pumping plant is 10,300 cfs, the plant can be operated to reduce power grid impacts by running all available pumps at night and fewer during the higher energy-demand hours, even when CCF is diverting the maximum daily permitted rate.

There are some water years (primarily wetter years) when excess conditions exist for a sufficient portion of the year such that enough water can be diverted from the Delta to fill the SWP south of Delta reservoirs and meet all SWP Contractor demands without maximizing Banks Pumping Plant pumping capability every day of the year. However, CCF operations are more often supply limited. Under these conditions, CCF is typically operated to maximize the water captured, subject to the limitations of water quality, Delta standards, and a host of other variables, to meet SWP demands and fill storage south of the Delta.

San Luis Reservoir is an offstream storage facility located along the California Aqueduct downstream of Banks Pumping Plant. San Luis Reservoir is used by both Projects to augment deliveries to their contractors and water contractors during periods when Delta pumping is insufficient to meet downstream demands.

DWR stores water in San Luis Reservoir when Banks Pumping Plant pumping exceeds SWP Contractor demands, and releases water to the California Aqueduct system when Banks Pumping Plant pumping is insufficient to meet demands. The reservoir allows the SWP to meet peak-season demands that supplies available at Banks Pumping Plant.

San Luis Reservoir is generally filled in the spring or even earlier in some years. When all SWP demands are met, including diversion to storage facilities south of the Delta, and Table A demands, and the Delta is in excess conditions, DWR would use available excess pumping capacity at Banks Pumping Plant to make excess water supplies, called Article 21 water under the long-term SWP water supply contracts, available to the SWP Contractors.

Article 21 describes the conditions under which water can be delivered in addition to the amounts specified in Table A of the contracts.

Article 21 provides, in part: "Each year from water sources available to the project, the State shall make available and allocate interruptible water to contactors. Allocations of interruptible water in any one year may not be carried over for delivery in a subsequent year, nor shall the delivery of water in any year impact a contractor's approved deliveries of annual [Table A water] or the contractor's allocation of water for the next year. Deliveries of interruptible water in excess of a contractor's annual [Table A water] may be made if the deliveries do not adversely affect the State's delivery of annual [Table A water] to other contractors or adversely affect project operations…"

Unlike Table A water, which is an allocated annual SWP supply made available for scheduled delivery throughout the year, Article 21 water is an interruptible water supply made available only when certain conditions exist. However, while not a dependable supply, Article 21 water is an important part of the total SWP supplies provided to the SWP contractors. As with all SWP water, Article 21 water is pumped consistent with the existing terms and conditions of SWP water rights permits, and is pumped from the Delta under the same environmental, regulatory, and operational constraints that apply to all SWP operations.

When Article 21 water is only available as long as the required conditions exist as determined by DWR. Since Article 21 deliveries are in addition to scheduled Table A deliveries, this supply is delivered to SWP contractors that can, on relatively short notice, put it to beneficial use. SWP contractors have used Article 21 water to meet needs such as additional short-term irrigation demands, replenishment of local groundwater basins, short-term substitution of local supplies and storage in local surface reservoirs for later use by the requesting SWP contractor, all of which provide SWP contractors with opportunities for better water management through more efficient coordination with their local water supplies. Allocated Article 21 water to a SWP contractor cannot be transferred.

Article 21 water is typically offered to SWP contractors on a short-term (daily or weekly) basis when all of the following conditions exist: the SWP share of San Luis Reservoir is physically full, or projected to be physically full; other SWP reservoirs south of the Delta are at their storage targets or the SWP conveyance capacity to fill these reservoirs is maximized; the Delta is in excess condition; current Table A and SWP operational demands are being fully met; and Banks Pumping Plant has export capacity beyond that which is needed to meet all Table A and other SWP operational demands. The increment of available unused Banks Pumping Plant capacity is offered as the Article 21 delivery capacity. SWP contractors then indicate their desired rate of delivery of Article 21 water. DWR allocates the available Article 21 water in proportion to the requesting SWP contractors annual Table A amounts if requests exceed the amount offered. Deliveries can be discontinued at any time when SWP operations change. In the modeling for Article 21, deliveries are only made in months when the SWP share of San Luis Reservoir is full. In actual operations, Article 21 may be offered a short period in advance of actual filling.

By April or May, demands from both agricultural and M&I SWP Contractors usually exceed the pumping rate at Banks, and releases from San Luis Reservoir to the SWP facilities are needed to supplement the Delta pumping at Banks Pumping Plant to meet SWP contractor demands for Table A water

During the summer period, DWR is also releasing water from Lake Oroville to supplement Delta inflow and allow Banks Pumping Plant to export the stored Lake Oroville water to help meet demand. These releases are scheduled to maximize export capability and gain maximum benefit from the stored water while meeting fish flow requirements, temperature requirements, Delta water quality, and all other applicable standards in the Feather River and the Delta.

DWR must balance storage between Lake Oroville and San Luis Reservoirs carefully to meet flood control requirements, Delta water quality and flow requirements, and optimize the supplies to its SWP water contractors consistent with all environmental constraints. Lake Oroville may be operated to move water through the Delta to San Luis Reservoir via Banks Pumping Plant under different schedules depending on Delta conditions, reservoir storage volumes, and storage targets. Predicting those operational differences is difficult, as the decisions reflect operator judgment based on many real-time factors as to when to move water from Lake Oroville to San Luis Reservoir.

The SWP share of San Luis Reservoir is drawn down to meet SWP contractor demands and usually reaches its low point in late August or early September. From September through early October, demand for deliveries usually drops below the capacity of Banks Pumping Plant to divert from the Delta, and DWR can begin diverting water to San Luis Reservoir to begin refilling the reservoir. Unregulated flow reaching the Delta typically continues to decline throughout the fall until the first major storms occur, typically last fall or winter. Once the fall and winter storms increase runoff into the Delta, Banks Pumping Plant can increase its pumping rate and, in all but the driest years, eventually fill the state portion of San Luis Reservoir before April of the following year.

3A.5.2 Water Service Contracts, Allocations, and Deliveries

The following discussion presents DWR's practices for determining the overall amount of Table A water that can be allocated annually and the allocation process itself. Many variables control how much water the SWP can capture and provide to its SWP water contractors for beneficial use.

The allocations are developed from analysis of a broad range of variables that include the following.

- Volume of water stored in Lake Oroville.
- Flood operation restrictions at Lake Oroville.
- Volume of water stored in Lake Oroville.
- End-of- year target for water stored in Lake Oroville.
- Volume of water stored in San Luis Reservoir.
- End-of-month targets for water stored in San Luis Reservoir.
- Snow survey results.
- Forecasted runoff.
- Feather River flow requirements for fish habitat.
- Feather River service area delivery obligations.
- Anticipated Feather River downstream of Lake Oroville.
- Anticipated depletions in the Sacramento River basin.
- Anticipated Delta flow and water quality requirements.
- Precipitation and streamflow conditions since the last snow surveys and forecasts.
- SWP water contract delivery requests and delivery patterns.

From these and other variables, DWR staff estimates the SWP water supply available to meet Table A water deliveries SWP contractors and other SWP needs. The initial allocation announcement by the Director of DWR is made by December 1 of each year. The allocation of water is made with a conservative assumption of future precipitation, and generally in graduated steps, carefully avoiding over-allocating water before the hydrologic conditions are well defined for the year. The allocation of the available SWP supply to the SWP contractors is based on the SWP contractors' initial requests for Table A water. As the year proceeds and more information is available on the hydrologic conditions, the SWP contractors may revise their initial Table A water requests considering their actual local supplies.

Other influences affect the accuracy of estimates of annual demand for Table A water and the resulting allocation percentage. One factor is the contractual ability of SWP contractors to carry over allocated but undelivered Table A from one year to the next if capacity is available in San Luis Reservoir. SWP contractors would generally use their carryover supplies early in the calendar year if it appears that the capacity would be needed for SWP operations. Carryover supplies left in San Luis Reservoir by SWP contractors may result in higher storage levels in San Luis Reservoir at December 31 than would have occurred in the absence of carryover. The carryover program, when available, provides an opportunity for the SWP contractors to temporarily store allocated Table A water outside their service area. As Project pumping for SWP operations fills the SWP share of San Luis Reservoir, the SWP contractors are notified to take or lose their carryover supplies. If the SWP contractors are unable to take delivery of any of their carryover water, the carryover water converts to Project water as San Luis Reservoir fills. Article 21 water may become\s available for delivery to SWP Contractors if the demand for SWP operations are met.

The total water exported from the Delta and delivered by the SWP in any year is a function of a number of variables beyond those listed above that help determine Table A allocations.

The total amount of Article 21 water delivered does not provide a measure of the change in Delta diversions attributable to Article 21 deliveries. Instead, one must analyze the total exports from the Delta.

3A.5.2.1 Monterey Agreement

In 1994, DWR and certain representatives of the SWP water contractors negotiated a set of principles designed to modify the long-term SWP water supply contracts. This set of principles, which came to be known as the Monterey Agreement, helped to settle long-term water allocation disputes and to establish new water management strategies for the SWP. An Environmental Impact Report (EIR) was prepared on the Monterey Agreement and certified in 1995. Following certification of the EIR, 27 of the 29 SWP water contractors incorporated most of the principles into a contract amendment which is known as the Monterey Amendment. The Monterey Amendment was implemented in 1996. The 1995

EIR was subject to judicial challenge. In 2000, the EIR was found to be inadequate. DWR, the SWP water contractors, and the plaintiffs entered into a Settlement Agreement in 2003. As a result of the Settlement Agreement, the Court issued an order in June 2003 that the EIR be decertified and that DWR prepare a new EIR. The order also required DWR to continue to operate the SWP in accordance with the Monterey Amendment as it had done since 1996 and in accordance with the Settlement Agreement. A draft of the new EIR was released in October 2007. After incorporating over 600 comments, the final EIR was filed with the State Clearinghouse on May 5, 2010. After considering the final EIR and the alternatives, DWR approved the proposed project of continuing to operate under the existing Monterey Amendment and Settlement Agreement. The EIR, and the validity of the Monterey Amendment, was challenged in June 2010 and the issues raised in the complaints are currently being litigated.

3A.5.3 Project Facilities

3A.5.3.1 Oroville Field Division

Oroville Dam and related facilities comprise a multipurpose project. The reservoir stores winter and spring runoff, which is released into the Feather River to meet the Project's needs, Delta water quality, and fish and wildlife protection. It also provides p electrical generation, including pumpback operations, 750 TAF of flood control storage, and recreation opportunities.

The Oroville Project facilities include two small embankments, Bidwell Canyon and Parish Camp Saddle Dams and Oroville Dam which forms Lake Oroville. The lake has a surface area of 15,810 acres, a storage capacity of 3,538 TAF, 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.

A maximum of 17,400 cfs can be released through the Edward Hyatt Power Plant, located underground near the left abutment of Oroville Dam. Three of the six units are conventional generators driven by vertical-shaft, Francis-type turbines. The other three are motor-generators coupled to Francis-type, reversible pump turbines. The latter units allow pumped storage operations. The intake structure has an overflow type shutter system that determines the level from which water is drawn.

Approximately 4 miles downstream of Oroville Dam and Edward Hyatt Power Plant 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 (Thermalito Diversion Pool) for Edward Hyatt Power Plant. 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 Power

Plant, with a capacity of 615 cfs that releases water to the low-flow section of the Feather River.

Thermalito Power Canal hydraulically links the Thermalito Diversion Pool to the Thermalito Forebay (11.768 TAF), which is the off-stream regulating reservoir for Thermalito Power Plant.

Thermalito Power Plant is a generating-pumping plant operated in tandem with the Edward Hyatt Power Plant. Water released to generate power in excess of local and downstream requirements is conserved in storage and, at times, pumped back through both power plants into Lake Oroville during off-peak hours. Energy price and availability are the two main factors that determine if a pumpback operation is economical. Pumpback operation typically occur during off-peak hours when energy prices are lower. The Oroville Thermalito Complex has a capacity of approximately 17,000 cfs through the power plants. Water is returned to the Feather River via the Thermalito Afterbay river outlet.

Five agricultural districts divert water directly from the Thermalito Afterbay under the terms of water right settlement agreement with DWR. The diversion facilities replace the historic river diversion used by the local districts prior to the construction of the Thermalito Complex. The total capacity of afterbay diversions during peak demands is 4,050 cfs.

The Feather River Fish Hatchery (FRFH), mitigation for the construction of Oroville Dam, rears Chinook Salmon and steelhead and is operated by CDFW. The NMFS FERC BO is being developed at this time, and is considered to be implemented under all of the alternatives and the Second Basis of Comparison in this EIS. Both indirect and direct take resulting from FRFH operations will be authorized through Section 4(d) of the Endangered Species Act, in the form of NMFS-approved Hatchery and Genetic Management Plans (HGMPs). DWR and CDFW are jointly preparing HGMPs for the spring and fall-run Chinook Salmon and steelhead production programs at the Feather River Fish Hatchery.

3A.5.3.1.1 Current Operations—Minimum Flows and Temperature Requirements

Operation of Lake Oroville would continue under existing criteria until DWR receives the new FERC license. The temperature of the water released from Oroville Dam is designed to meet the temperature requirements for the FRFH, under the August 1983 CDFW Agreement titled Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish and Wildlife, and for Robinson Riffle while also conserving the coldwater pool in Lake Oroville. Current operation indicates that water temperatures at Robinson Riffle are almost always met when the hatchery objectives are met.

Water is withdrawn from Lake Oroville at depths that provide sufficiently cold water to meet the FRFH and Robinson Riffle temperature targets. The reservoir depth from which water is released initially determines the river temperatures, but atmospheric conditions, which fluctuate from day to day, influence downstream river temperatures. Altering the reservoir release depth requires installation or removal of shutters at the intake structures. Shutters are held at the minimum depth necessary to release water that meets the FRFH and Robinson Riffle criteria. In order to conserve the coldwater pool during dry years, DWR strives to meet the Robinson Riffle temperatures by increasing releases to the low flow channel (LFC) rather than releasing colder water.

Additionally, DWR maintains a minimum flow of 600 cfs within the Feather River LFC as required by the 1983 CDFW Agreement (except during flood events when flows are governed by USACE's Water Control Manual and under certain other conditions as described in the 1984 FERC order). Downstream of the Thermalito Afterbay Outlet, in the high flow channel (HFC), per the license and the 1983 CDFW Agreement, minimum releases for flows in the Feather River are 1,000 cfs from April through September and 1,700 cfs from October through March, when the April-to-July unimpaired runoff in the Feather River is greater than 55 percent of normal. When the April-to-July unimpaired runoff is less than 55 percent of normal, the minimum flow requirements are 1,000 cfs from March to September and 1,200 cfs from October to February (Table 3A.11). The 1983 CDFW Agreement also states that if the April 1 runoff forecast in a given year indicates that the reservoir level would be drawn down to 733 feet, water releases for fish may be reduced, but not by more than 25 percent.

In addition, according to the 1983 Agreement, during the period of October 15 to November 30, if the average highest 1-hour flow of combined releases exceeds 2,500 cfs, then the minimum flow must be no lower than 500 cfs less than that flow through the following March 31 (with the exception of flood management, accidents, or maintenance.) In practice, flows are maintained below 2,500 cfs from October 15 to November 30 to prevent spawning in the overbank areas.

Table 3A.11 Combined Minimum Instream Flow Requirements in the Feather River below Thermalito Afterbay Outlet When Lake Oroville Elevation is Projected to be Greater vs. Less than 733 Feet in the Current Water Year

Conditions	Period	Minimum Flows (cfs)
When Lake Oroville Elevation is Projected to be Greater Than 733 feet and the Preceding Water Year's April–July Water Conditions are > 55 percent of Normal[a]	October–February	1,700
	March	1,700
	April–September	1,000
When Lake Oroville Elevation is Projected to be Greater Than 733 feet and the Preceding Water Year's April–July Water Conditions are < 55 percent of Normal[a]	October–February	1,200
	March	1,000
	April–September	1,000
When Lake Oroville Elevation is Projected to be Less Than 733 feet in the Current Water Year[b]	October–February	900 < flow < 1,200
	March	750 < flow < 1,000
	April–September	750 < flow < 1,000

Notes:

a. Normal is defined as the Mean April–July Unimpaired Runoff of the Feather River near Oroville of 1,942 TAF (1911–1960).

b. In accordance with FERC's Order Amending License dated September 18, 1984, Article 53 was amended to provide a third tier of minimum flow requirements defined as follows: If the April 1 runoff forecast in a given water year indicates that, under normal operation of Project 2100, the reservoir level would be drawn to elevation 733 feet (approximately 1,500 TAF), releases for fish life in the above schedule may suffer monthly deficiencies in the same proportion as the respective monthly deficiencies imposed upon deliveries of water for agricultural use from the Project. However, in no case shall the fish water releases in the above schedule be reduced by more than 25 percent.

Current operations of the Oroville Facilities are governed by water temperature requirements at two locations: the FRFH and in the LFC at Robinson Riffle. DWR has taken various temperature management actions to achieve the water temperature requirements, including curtailing pumpback operations, removing shutters at the intakes of the Hyatt Pumping-Generating Plant, releasing flow through the river valves (for FRFH only), and redirecting flows at the Thermalito Diversion Dam to the LFC (for Robinson Riffle only).

To date, the river valves have been used infrequently. Prior to 1992, they were used twice: first in 1967 during the initial construction of the dam, and second in 1977 during the drought of record. Since 1992, the river valves have only been used for temperature control: in 2001, 2002, and 2008. DWR plans to manage its cold water storage and its intake shutters in order to meet its temperature obligations. Other than local diversions, outflow from the Oroville Project is to the Feather River at the LFC and Thermalito Afterbay. Combined outflow typically varies from spring seasonal highs averaging 8,000 cfs to between 1,200 cfs and 2,400 cfs in the fall. The average annual outflow from the Project is in excess of 3 MAF to support downstream water supply, environmental, and water quality needs.

Table 3A.12 shows an example of releases from Oroville Project Facilities for various downstream uses during dry hydrologic conditions (Water Years [WYs] 2008 and 2009). As a practical matter, water supply is released for exports only after all other Project obligations are met, including Delta requirements and deliveries to local settlement contractors. A portion of the water released for minimum instream requirements and may be exported in the Delta for other water supply purposes.

Table 3A.12 Historical Records of Releases from the Oroville Facilities in 2008 and 2009, by Downstream Use

Downstream Use	Water Year 2008 Release		Water Year 2009 Release	
	Volume (TAF)	Percentage	Volume (TAF)	Percentage
Feather River Service Area	1,039	47	1,077	40
Instream and Delta Requirements	1,043	47	1,140	42
Flood Management	0	0	0	0
Support of Exports	130	6	506	19
Total	2,212	100	2,723	100

Source: DWR SWP Operations Control Office.

3A.5.3.1.2 Low Flow Channel

The 1983 Agreement specifies that DWR release a minimum of 600 cfs into the Feather River from the Thermalito Diversion Dam for fishery purposes. This is the total volume of flows from the diversion dam outlet, diversion dam power plant, and FRFH pipeline.

3A.5.3.1.3 High Flow Channel

Based on the 1983 Agreement, Table 3A.13 summarizes the minimum flow requirement for the HFC when releases would not draw Lake Oroville below elevation 733 feet above mean sea level (ft msl).

Table 3A.13 High Flow Channel Minimum Flow Requirements as Measured Downstream from the Thermalito Afterbay Outlet

Forecasted April-through-July Unimpaired Runoff (Percent of Normal*)	Minimum Flow in HFC (cfs)		
	October through February	March	April through September
55 percent or greater	1,700	1,700	1,000
Less than 55 percent	1,200	1,000	1,000

Source: 1983 Agreement.

HFC = High Flow Channel.

* The preceding water year's unimpaired runoff shall be reported in Licensee's Bulletin 120, Water Conditions in California-Fall Report. The term "normal" is defined as the April-through-July mean unimpaired runoff near Oroville of 1,942 TAF in the period of 1911 through 1960.

If the April 1 forecast in a given water year indicates that Lake Oroville would be drawn down to elevation 733 feet mean sea level, minimum flows in the HFC may be diminished on a monthly average basis, in the same proportion as the respective monthly deficiencies imposed on deliveries for agricultural use of the Project. However, in no case shall the minimum flow releases be reduced by more than 25 percent. If between October 15 and November 30, the highest total 1-hour flow exceeds 2,500 cfs, DWR shall maintain a minimum flow within 500 cfs of that peak flow, unless such flows are caused by flood flows, or an inadvertent equipment failure or malfunction.

3A.5.3.2 Temperature Requirements

3A.5.3.2.1 Low Flow Channel

NMFS has established a water temperature requirement for steelhead trout and spring-run Chinook Salmon at Feather River RM 61.6 (Robinson Riffle in the LFC) from June 1 through September 30. The water temperature should be maintained at less than or equal to 65°F on a daily average basis.

3A.5.3.2.2 High Flow Channel

While no numeric temperature requirement currently exists for the HFC, the 1983 Agreement requires DWR to provide suitable Feather River water temperatures for fall-run salmon not later than September 15, and to provide for suitable water temperatures below the Thermalito Afterbay Outlet for shad, striped bass, and other warm water fish between May 1 and September 15.

Current FRFH intake water temperature, as required by the 1983 CDFW and DWR Agreement and the FERC license are in Table 3A.14.

Table 3A.14 Feather River Fish Hatchery Temperature Requirements

Period	Temperature (°F) (±4°F Allowed)
April 1 – November 30	
April 1–May 15	51
May 16–May 31	55
June 1–June 15	56
June 16–August 15	60
August 16–August 31	58
September 1–September 30	52
October 1–November 30	51
December 1–March 31	No greater than 55

3A.5.3.3 Flood Control

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 USACE. The Federal Government shared the expense of Oroville Dam, which provides up to 750 TAF 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.

3A.5.3.4 Feather River Ramping Rate Requirements

Maximum allowable ramp-down release requirements are intended to prevent rapid reductions in water levels that could potentially cause redd dewatering and stranding of juvenile salmonids and other aquatic organisms. Ramp-down release requirements to the LFC during periods outside of flood management operations, and to the extent controllable during flood management operations, are shown in Table 3A.15.

Table 3A.15 Lower Feather River Ramping Rates

Releases to the Feather River Low Flow Channel (cfs)	Rate of Decrease (cfs)
5,000 to 3,501	1,000 per 24 hours
3,500 to 2,501	500 per 24 hours
2,500 to 600	300 per 24 hours

Source: National Marine Fisheries Service 2004.

3A.5.3.4.1 Federal Energy Regulatory Commission Relicensing of the Oroville Project

Until FERC issues the new license for the Oroville Project, DWR will not significantly change the operations of the facilities. When the FERC license is issued, it is assumed that the future flows will remain the same downstream of Thermalito Afterbay Outlet.

The original FERC license to operate the Oroville Project expired in January 2007. Since then, annual licenses have been issued, with DWR operating to the existing FERC license. FERC continues to issue an annual license until it is prepared to issue the new 50-year license. To prepare for the expiration of the FERC license, DWR began working on the relicensing process in 2001. As part of the process, DWR entered into an SA, signed in 2006, with state, federal, and local agencies, SWP water contractors, non-governmental organizations, Tribal governments, and others to implement improvements within the FERC boundary. The FERC boundary includes all of the Oroville Project facilities, extends upstream into the tributaries of Lake Oroville, includes portions of the LFC on the lower Feather River and downstream of the Thermalito Afterbay Outlet into the HFC. In addition to the SA, a Habitat Expansion Agreement was negotiated to address the fish passage issue over Oroville Dam and NMFS and USFWS's Section 18 Authority under the Federal Power Act.

FERC prepared a Final EIS for the Oroville FERC re-licensing and completed it in 2007. A Final EIR was prepared by DWR and completed in 2008. A draft BO was prepared by NMFS in 2009 but is not yet final. SWRCB issued the Clean Water Act Section 401 Certification (401 Certification) for the project in 2010. The new FERC license has not been adopted, but is anticipated to include the FERC license terms and conditions, the 401 Certification, and the terms and conditions therein; DWR will also comply with the requirements in the NMFS BO.

The new FERC license may include most if not all of the commitments from the SA. The SA does not change the flows in the HFC although there would be a proposed increase in minimum flows in the LFC. The SA includes habitat restoration actions such as side-channel construction, structural habitat improvement such as boulders and large woody debris, spawning gravel augmentation, a fish counting weir, riparian vegetation and floodplain restoration, and facility modifications to improve coldwater temperatures in the low and high flow channels. The SA, EIR, and the FERC Biological Assessment provide substantial detail on the SA restoration actions in the Lower Feather River.

3A.5.3.4.2 Minimum Flows in the Low Flow and High Flow Channels

The SA requires a minimum flow of 700 cfs to be released into the LFC. The minimum flow is 800 cfs from September 9 to March 31 of each year to accommodate spawning of anadromous fish, unless the NMFS, USFWS, CDFW, and SWRCB provide a written notice that a lower flow (between 700 cfs and 800 cfs) substantially meets the needs of anadromous fish. If DWR receives such a notice, it may operate consistent with the revised minimum flow. HFC flows would remain the same as the existing license, consistent with the 1983 DWR and CDFW Operating Agreement to continue to protect Chinook Salmon from redd dewatering (A108.2 of the SA [Appendix C]).

3A.5.3.4.3 Water Temperatures for the Feather River Fish Hatchery

When the FERC license is issued, DWR would use the temperatures in Table 3A.16 as targets, and would seek to achieve them through the use of operational measures described below.

Table 3A.16 Maximum Mean Daily Temperatures

Period	Maximum Mean Daily Temperature (°F)
September 1–September 30	56
October 1–May 31	55
June 1–August 31	60

The maximum mean daily temperatures are calculated by adding the hourly temperatures achieved each day and dividing by 24. DWR would strive to meet maximum mean daily temperatures through operational changes including but not limited to (1) curtailing pump-back operation; (2) removing shutters on Hyatt intake; and (3) altering river valve refurbishment. DWR would consider the use of the river valve up to a maximum of 1500 cfs; however these flows need not exceed the actual flows in the HFC, and should not be less than those specified in HFC minimum flows described above, which would not change with the new FERC license. During this interim period, DWR would not be in violation if the maximum mean daily temperatures are not achieved through operational changes.

Prior to FERC license implementation, DWR agreed to begin the necessary studies for the refurbishment or replacement of the river valve. On October 31, 2006, DWR submitted to specific agencies a Reconnaissance Study of Facilities Modification to address temperature habitat needs for anadromous fisheries in the LFC and the HFC. Under the provisions of SA Appendix B Section B108(a), DWR has begun a study to evaluate whether to refurbish or replace the river valve that may at times be used to provide cold water for the FRFH.

Upon completion of facilities modification(s) as provided in A108, and no later than the end of year ten following license issuance, the temperatures would become requirements, and DWR would not exceed the maximum mean daily temperatures for the remainder of the License term, except in Conference Years as referenced in A107.2(d).

During the term of the FERC license, DWR would not exceed the hatchery water temperatures in Table 3A.17. There would be no minimum temperature requirement except for the period of April 1 through May 31, during which the temperatures would not fall below 51°F.

Table 3A.17 Hatchery Water Temperatures

Period	Maximum Hatchery Water Temperature (°F)
September 1–September 30	56
October 1–November 30	55
December 1–March 31	55
April 1–May 15	55
May 16–May 31	59
June 1–June 15	60
June 16–August 15	64
August 16–August 31	62

Upon completion of facilities modification(s) as provided in A108 (discussed below), DWR may develop a new table for hatchery temperature requirements that is at least as protective as Table 3A.17. If a new table is developed, it would be developed in consultation with the Ecological Committee, including specifically USFWS, NMFS, CDFW, SWRCB, and RWQCBs. The new table would be submitted to FERC for approval, and upon approval shall become the temperature requirements for the hatchery for the remainder of the license term.

During Conference Years, as defined in A108.6, DWR would confer with USFWS, NMFS, CDFW, and SWRCB to determine proper temperature and hatchery disease management goals.

3A.5.3.4.4 Water Temperatures in the Lower Feather River

Under the SA, DWR is committing to a Feasibility Study and Implementation Plan to improve temperature conditions (facilities modification[s]) for spawning, egg incubation, rearing and holding habitat for anadromous fish in the LFC and HFC (A108.4). The Plan would recommend a specific alternative for implementation and would be prepared in consultation with the resource agencies.

Prior to the facilities modification(s) described in Article A108.4, if DWR does not achieve the applicable Robinson Riffle temperature (specified in Table 2-22 of the FERC license agreement) upon release of the specified minimum flow, DWR would singly, or in combination with other parties, perform the following actions:

- Curtail pump-back operation.
- Remove shutters on Hyatt Intake.
- Increase flow releases in the LFC up to a maximum of 1500 cfs, consistent with the minimum flow standards in the HFC and temperature targets specified in Table 2-22 of the FERC license agreement; and if the temperatures are not met there is no license violation.

If in any given year DWR anticipates that these measures would not achieve the temperatures in Table 3A.18, Low Flow Channel as Measured at Robinson Riffle, DWR would consult with the NMFS, USFWS, CDFW, and SWRCB to discuss potential approaches to best managing the remaining coldwater pool in Lake Oroville, which may result in changes in the way Licensee performs actions (1), (2), and (3) listed above.

Table 3A.18 Low Flow Channel as Measured at Robinson Riffle

Month	Daily Mean Value Temperature (°F)
January	56°F
February	56°F
March	56°F
April	56°F
May 1–15	56–63°F*
May 16–31	63°F
June 1–15	63°F
June 16–30	63°F
July	63°F
August	63°F
September 1–8	63–58°F*
September 9–30	58°F
October	56°F
November	56°F
December	56°F

* Indicates a period of transition from the first temperature to the second temperature.

After completing the facilities modification(s), DWR would no longer be required to perform the measures listed in (1), (2), and (3), unless temperatures in Table 3A.17, Hatchery Water Temperatures, are exceeded. DWR would operate the Project to meet temperature requirements, unless it is a Conference Year. The proposed water temperature objectives, measured at the southern FERC project boundary, would be evaluated for potential water temperature improvements in the HFC. DWR would study options for facilities modification(s) to achieve those temperature benefits.

There would be a testing period of at least 5 years to determine whether the HFC temperature benefits are being realized. At the end of the testing period, DWR would prepare a testing report that may recommend changes in the facilities, compliance requirements for the HFC and the definition of Conference Years (those years where DWR may have difficulties in achieving the temperature requirements due to hydrologic conditions.) The challenges of implementing temperatures objectives would require the phased development of water temperature objectives and likely, a revision to the objectives prior to values in Table 3A.19, High Flow Channel as Measured at Downstream Project Boundary, becoming a compliance obligation.

Table 3A.19 High Flow Channel as measured at Downstream Project Boundary

Month	Daily Mean Value Temperature (°F)
January	56
February	56
March	56
April	61
May	64
June	64
July	64
August	64
September	61
October	60
November	56
December	56

3A.5.3.4.5 Habitat Expansion Agreement

The Habitat Expansion Agreement is a component of the 2006 SA to address DWR obligations in regard to blockage and fish passage issues related to the construction of Oroville Dam. Because it deals with offsite mitigation, it will not be included in the new FERC license.

Construction of the Oroville Facilities and PG&E's construction of other hydroelectric facilities on the upper Feather River tributaries blocked passage and reduced available habitat for ESA listed anadromous salmonids Central Valley spring-run Chinook Salmon and steelhead. The reduction in spring-run habitat resulted in spatial overlap with fall-run Chinook Salmon and has led to increased redd superimposition, competition for limited habitat, and genetic introgression. FERC relicensing of hydroelectric projects in the Feather River basin has focused attention on the desirability of expanding spawning, rearing and adult holding habitat available for Central Valley spring-run Chinook Salmon and steelhead. The SA Appendix F includes a provision to establish a habitat enhancement program with an approach for identifying, evaluating, selecting and implementing the most promising action(s) to expand such spawning, rearing and adult holding habitat in the Sacramento River Basin as a contribution to the conservation and recovery of these species. The specific goal of the Habitat Expansion Agreement is to expand habitat sufficiently to accommodate an estimated net increase of 2,000 to 3,000 spring-run or steelhead for spawning (Habitat Expansion Threshold). The population size target of 2,000 to 3,000 spawning individuals was selected because it is approximately the number of spring-run Chinook Salmon and steelhead that historically migrated to the upper Feather River. Endangered species issues will be addressed and documented on a specific project basis for any restoration actions chosen and implemented under the Habitat Expansion Agreement.

3A.5.3.4.6 Anadromous Fish Monitoring on the Lower Feather River

Until the new FERC license is issued and until a new monitoring program is adopted, DWR will continue to monitor anadromous fish in the Lower Feather River. As required in the SA (Article A101), within 3 years following the FERC license issuance, DWR will develop a comprehensive Lower Feather River Habitat Improvement Plan that will provide an overall strategy for managing the various environmental measures developed for implementation, including the implementation schedules, monitoring, and reporting. Each of the programs and components of the Lower Feather River Habitat Improvement Plan will be individually evaluated to assess the overall effectiveness of each action within the Lower Feather River Habitat Improvement Plan.

3A.5.3.5 Delta Field Division

SWP facilities in the southern Delta include CCF, John E. Skinner Fish Facility, and the Banks Pumping Plant. CCF is a 31 TAF reservoir located in the southwestern edge of the Delta, about 10 miles northwest of the city of Tracy. CCF provides storage to allow off-peak pumping of water exported through Banks Pumping Plant, 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 CCF are regulated by five radial gates.

3A.5.3.5.1 John E. Skinner Delta Fish Protective Facility

The John E. Skinner Delta Fish Protective Facility is located west of the CCF, 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 directed away from the facility by a 388-foot long trash boom. Smaller fish are diverted from the intake channel into bypasses by a series of metal 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.

3A.5.3.5.2 Harvey O. Banks Pumping Plant

The Banks Pumping Plant is in the south Delta, about 8 miles northwest of Tracy and marks the beginning of the California Aqueduct. The plant provides the initial lift of water 244 feet into 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 nominal capacity of the Banks Pumping Plant is 10,300 cfs.

Permits issued by the USACE regulate the rate of diversion of water into CCF for pumping at Banks. This diversion rate is normally restricted to 6,680 cfs as a three-day average inflow to CCF and 6,993 cfs as a one-day average inflow to CCF. CCF diversions may be greater than these rates between December 15 and March 15, when the inflow into CCF may be augmented by one-third of the San Joaquin River flow at Vernalis when those flows are equal to or greater than 1,000 cfs.

500 cfs Diversion Increase During July, August, and September

During the months of July, August, and September, the maximum allowable daily diversion rate into CCF was increased from 13,870 acre-feet to 14,860 acre-feet and 3-day average diversions from 13,250 acre-feet to 14,240 acre-feet (500 cfs per day equals 990 acre-feet per day). The increase in diversions was permitted in 2000, and was recently extended through 2016. The purpose of this diversion increase into CCF for use by the SWP is to recover export reductions made due to actions taken to benefit fisheries resources. The increased diversion rate does not result in any increase in water supply deliveries above those that would occur in the absence of the increased diversion rate. This increased diversion over the 3-month period could result in an amount not to exceed 90 TAF each year.

Variations to hydrologic conditions coupled with regulatory requirements may limit the ability of the SWP to fully utilize the proposed increased diversion rate. Also, facility capabilities may limit the ability of the SWP to fully utilize the increased diversion rate.

Implementation of this action is contingent on meeting the following conditions.

- The increased diversion rate would not result in greater annual SWP water supply allocations than would occur in the absence of the increased diversion rate. Water pumped due to the increased capacity would only be used to offset reduced diversions that occurred or would occur because of actions taken to benefit fisheries.
- Use of the increased diversion rate would be in accordance with all terms and conditions of existing BOs governing SWP operations.
- All three temporary agricultural barriers (Middle River, Old River near Tracy and Grant Line Canal) must be in place and operating when SWP diversions are increased.

Between July 1 and September 30, if the combined salvage of listed fish species reaches a level of concern, the relevant fish regulatory agency would determine whether the 500 cfs increased diversion is or continues to be implemented.

Other SWP-operated facilities in and near the Delta include the NBA, the South Bay Aqueduct (SBA), the Suisun Marsh Salinity Control Gates (SMSCG), Roaring River Distribution System (RRDS), and up to four temporary barriers in the south Delta.

3A.5.3.5.3 Clifton Court Forebay

Clifton Court Forebay Aquatic Weed Control Program

Dense growth of submerged aquatic weeds in CCF, predominantly Egeria densa, can cause severe head loss and pump cavitation at Banks Pumping Plant when the stems of rooted plants break free, combine into "mats," and drift into the trash racks. This mass of uprooted and broken vegetation essentially forms a watertight plug at the trash racks and vertical louver array. The resulting blockage necessitates a reduction in the water pumping rate to prevent potential equipment damage through pump cavitation. Cavitation creates excessive wear and deterioration of the pump impeller blades. Excessive floating weed mats also block the passage of fish into the Skinner Fish Facility, thereby reducing the efficiency of fish salvage operations. Ultimately, this all results in a reduction in the volume of water diverted by the SWP. Algal blooms in CCF are also problematic because they degrade drinking water quality through tastes and odors and production of algal toxins.

Beginning in 1995, DWR applied copper-based herbicide complexes to control aquatic weeds and algal blooms in CCF. These herbicides included copper sulfate pentahydrate, Komeen,® and Nautique®. These herbicides were applied on an as-needed basis. Komeen® is a chelated copper herbicide (copper-ethylenediamine complex and copper sulfate pentahydrate) and Nautique® is a copper carbonate compound (see Sepro product labels).

The operational procedures for aquatic herbicide applications in CCF include:

- Apply aquatic pesticides as needed between July 1 and August 31.
- Monitor the salvage of listed fish at the Skinner Facility prior to the application of the herbicides in CCF.
- Close the radial intake gates at the entrance to CCF 24 hours prior to the application of herbicides to allow fish to move out of the proposed treatment areas and towards the salvage facility.
- The radial gates would remain closed for 24 hours after treatment to allow for at least 24 hours of contact time between the herbicide and the treated vegetation in the forebay. Gates would be reopened after a minimum of 48 hours.
- Komeen® would be applied by boat, starting at the shore and moving sequentially farther offshore in its application. Application would be made by a certified water contractor under the supervision of a California Certified Pest Control Advisor.
- Application of the herbicides would be to the smallest area possible that provides relief to SWP operations.

- Monitoring of the water column concentrations of copper is proposed during and after herbicide application. No monitoring of the copper concentration in the sediment or detritus is proposed.

Due to concerns that the pesticide treatments may adversely affect Green Sturgeon, during 2006 DWR ceased using aquatic pesticides and employed the use of a mechanical aquatic weed harvester.

If DWR resumes herbicide treatments in the CCF, they would occur only in July and August on an as-needed basis dependent upon the level of vegetation biomass in the enclosure. It is not possible to predict future CCF conditions with climate change. However, the frequency of herbicide applications is not expected to occur more than twice per year, as demonstrated by the history of past applications. Herbicides are typically applied early in the growing season when plants are susceptible to them during rapid growth and formation of plant tissues; or later in the season, when plants are mobilizing energy stores from their leaves towards their roots for overwintering senescence.

Aquatic weed management problems in CCF have historically been limited to about 700 acres of the 2,180 total water surface acres. Application of the herbicide during 1995–2006 was limited to only those areas in CCF that require treatment. The copper-based herbicides, Komeen® or Nautique, were applied by helicopter or boat to only those portions where aquatic weeds presented a management problem to the State.

Historically, algal problems in CCF have been caused by attached benthic cyanobacteria that produce unpleasant tastes and odors in the domestic drinking water derived from the SWP operations. Copper sulfate is applied to the nearshore areas of CCF when results of solid phase microextraction (American Public Health Association, American Water Works Association, and Water Environment Federation 2005) analysis exceed the control tolerances (2-methylisoborneol [MIB] < 5 nanograms per liter [ng/L] and geosmin < 10 ng/L are not detected by consumers in drinking water supplies) (California Department of Water Resources 2013). Geosmin and MIB are natural byproducts of algal chlorophyll production. Highest biomass of taste- and odor-producing cyanobacteria was present in the nearshore areas but not limited to shallow benthic zone. Historically, application areas varied considerably based on the extent of the algal infestation in CCF.

DWR receives Clean Water Act pollutant discharge coverage under the National Pollutant Discharge Elimination System (NPDES) Permit No. CAG990005 (General Permit) issued by SWRCB for application of aquatic pesticides to the SWP's aqueducts, forebays, and reservoirs. SWRCB functions as the USEPA's non-federal representative for implementation of the Clean Water Act in California.

A Mitigated Negative Declaration was prepared by DWR to comply with CEQA requirements associated with regulatory requirements established by SWRCB. DWR, a public entity, was granted a Section 5.3 Exception by SWRCB (Water

Quality Order 2004-0009-DWQ). Under the exception, DWR is not required to meet the copper limitation in receiving waters defined in DWR's Aquatic Pesticide Application Plan as occurring on an as-needed basis during the year, after other options have been exhausted.

3A.5.3.5.4 Proposed Measures to Reduce Fish Mortality

DWR plans to implement a number of projects to reduce fish mortality, including (1) implementing the CCF Fishing Facility Project, (2) improving fish conditions at the Curtis Landing Fish Release Site, (3) constructing a Fish Science Building for fish studies, (4) building two new release sites, (5) developing a CVP and SWP coordinated fish release plan, and (6) improving herbicide application procedures to protect listed species.

DWR plans to implement the CCF Fishing Facility Project to reduce salmon and steelhead pre-screen losses in CCF by (a) building a concrete support pad to improve crane maintenance of the radial gates, (b) improve angler access and conditions to reduce the number of predators affecting listed species, and (c) increase security operations.

DWR plans to rebuild the Curtis Landing fish release site to reduce salmon predation by; (a) building a larger pump to more effectively flush salvaged fish, (b) screening the water pump to prevent fish entrainment, and (c) building two release sites with improved facilities to improve fish releases and lengthen time between using repeated release sites.

DWR plans to open a Fish Science Building and storage warehouse at Skinner Fish Salvage Facility in order to conduct fisheries studies in support of improving endangered species protection for the State Water Project. The facilities would support; (a) the CCF Predation Study, (b) the Skinner Release Site Efficiency Study, (c) Acoustic Tagging Study, and (d) future studies related to the State Water Project.

DWR plans to build two new fish release sites that will help lengthen out the rotation time between release locations and will assist in reducing listed species predation at release sites. Facilities were created at Little Baja and Manzo Ranch on Sherman Island.

If DWR resumes application of Komeen® (copper-ethylenediamine complex) or similar aquatic herbicides, it would be applied according to the manufacturer's instructions, following the operational procedures described in Table P-24, Section 6.6.3 of the 2009 NMFS BO, and in accordance with state and federal law. CCF elevation would be raised to +2 feet above mean sea level for an average depth of about 6 feet within the maximum 700-water surface acre treatment zone. The herbicide would be applied at a rate of 13 gallons per surface acre to achieve a final operational concentration in the water body of 0.64 mg/L $Cu2+$ (640 parts per billion [ppb]). The application rate of 13 gallons per surface acre is calculated based on mean depth. The product label allows applications up to 1 mg/L (1,000 ppb or 1 ppm). DWR would apply Komeen® in accordance with the product label that states, "If treated water is a source of potable water, the residue of copper must not exceed 1 ppm (mg/L)."

In 2005, 770 surface acres were treated with Komeen®. CCF has a mean depth of 6 feet at 2 feet above mean sea level; thus the volume treated was 4,620 af.

The calculated concentration of Cu2+ for the 2005 application was 0.65 mg/L Cu2+. The copper level required to control Egeria densa (the main component of the CCF aquatic plant community) is 0.5–0.75 mg/L Cu2+. Source: Komeen® Specimen Label.

Toxicity testing and literature review of LC-50 levels for salmon, steelhead, Delta Smelt, and Green Sturgeon were conducted. Copper-complexes are generally much less toxic to fish than the inorganic copper salts, including copper sulfate. Once applied, the initial stock copper concentration is reduced rapidly by dilution, plant uptake, and adsorption to particulate matter. The half-life for the commercial copper-complexes is very short for the copper-EDA complexes (0.07 to 0.18 days). Komeen® applied according to the Specimen Label (SePro Corporation) in the receiving water would achieve final concentration levels. Based on the treatment elevation of +2 feet, only about 20 percent (4,630 af) of the 22,665 acre-feet CCF would be treated. If herbicide treatments resume, the copper would be applied beginning on one side of the CCF allowing fish to move out of the treatment area. In addition, Komeen® would be applied from boats at a slower rate than in previous years when a helicopter was used.

3A.5.3.6 South Bay Aqueduct

The SBA conveys water from the Delta through over 40 miles of pipelines and canals to the Zone 7 Water Agency, Alameda County, and Santa Clara Valley Water Districts, which in turn provide service to the cities of Livermore, Dublin, Pleasanton, San Ramon, Freemont, Newark, Union City, Milpitas, Santa Clara, and San Jose. The SBA was the first conveyance facility constructed for the SWP and was designed for a capacity of 300 cfs. The facility is currently being upgraded to increase the capacity to 430 cfs to meet Zone 7 Water Agency's future needs and provide operational flexibility to reduce SWP peak power consumption. Modeling of this facility uses the full 430 cfs capacity.

3A.5.3.7 North Bay Aqueduct Intake at Barker Slough

The Barker Slough Pumping Plant (BSPP) diverts water from Barker Slough into the NBA for delivery to the Solano County Water Agency (SCWA) and the Napa County Flood Control and Water Conservation District (Napa County FC&WCD) (NBA water contractors).

The NBA intake is located approximately 10 miles from the main stem Sacramento River at the end of Barker Slough. Delta Smelt monitoring is required at Barker Slough.

The existing NBA system has several existing and potential future limitations, as described in the following section.

3A.5.3.7.1 Existing Limitations

Water Quality

Water quality in Barker Slough becomes degraded during winter and spring rainfall events. The Barker Slough drainage basin is characterized by grazing lands, erodible soils, and urban uses. Rainfall runoff can include elevated levels of coliform bacteria, organic matter, turbidity, and pollutants. The water is costly to treat to meet drinking water standards.

Pumping Restrictions

The NBA SWP water contractors have an existing water supply through the NBA of 131,181 acre-feet per year based on existing contracts and water right settlements. The 2008 USFWS BO limited the total SWP annual diversion at the BSPP to approximately 71 TAF. In 2009, an incidental take permit issued CDFW for the preservation of longfin smelt populations imposed further pumping restrictions at the BSPP of a maximum of 50 cfs (7-day average flows) during dry and critical dry years from January 15 to March 31.

Water Supply Delivery Limitations

The NBA system had the design capacity of 175 cfs, provided all 10 pumps were installed at BSPP. There are currently only nine pumps (seven large, two small) at BSPP. Installation of the tenth pump was deferred, resulting in the current design capacity of 162.5 cfs. However, until late 2011, the system delivered a maximum of only 140 cfs due to thick bio-film growth on the interior of the NBA pipeline, which reduced the effective diameter of the pipe. In October 2011, maximum allowable pumping at BSPP was further reduced to keep the pressure in the pipeline within acceptable limits.

3A.5.3.7.2 Potential Future Limitations

Pumping Restrictions

The pumping capacity of the existing NBA system could be subjected to additional restrictions in the future. In June 2009, NMFS issued a BO that included determinations for winter and spring-run Chinook Salmon, Central Valley Steelhead and North American Green Sturgeon of the southern distinct population segment. State and federal agencies working on ways to improve the Delta ecosystem and water supply conveyance, including work under the Bay Delta Conservation Plan (BDCP), have identified the Yolo Bypass and Cache Slough Complex as important Wetlands Restoration Opportunity Areas. Implementing these developing strategies would likely support increases in Delta Smelt, longfin smelt and salmonid populations in the Barker Slough area. The increased presence of these listed species could result in further pumping restrictions at the BSPP as resource agencies work to balance ecosystem restoration and water supply delivery goals.

Projected Water Delivery Demands

The NBA SWP water contractors project that by 2030 they would need the NBA to deliver their total water supply of 131,181 af/year (compared to current withdrawal of 71 TAF/year). To meet projected future demand, required peak flow through the NBA is estimated at 240 cfs.

3A.6 Coordinated Facilities of the CVP and SWP

3A.6.1 Joint Project Facilities

3A.6.1.1 Suisun Marsh

Since the early 1970s, the California Legislature, SWRCB, Reclamation, CDFW, Suisun Resource Conservation District (SRCD), DWR, and other agencies have worked to preserve beneficial uses of Suisun Marsh in mitigation for perceived impacts of reduced Delta outflow on the salinity regime. Early on, salinity standards were set by SWRCB to protect alkali bulrush production, a primary waterfowl plant food. The most recent standard under SWRCB D-1641 acknowledges that multiple beneficial uses deserve protection.

A contractual agreement among DWR, Reclamation, CDFW, and SRCD 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. 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, SWRCB D-1485 codified salinity standards in 1978, which have been carried forward to SWRCB D-1641.

There are two primary physical mechanisms for meeting salinity standards set forth in SWRCB D-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. However, since Delta outflow cannot be actively managed by the Suisun Marsh Program, Marsh facility operations must be adaptive in response to changing salinity levels in the Delta.

3A.6.1.1.1 Suisun Marsh Wildlife Habitat Management, Preservation, and Restoration Plan

Reclamation, USFWS, CDFW, and federal and state agencies developed the Suisun Marsh Habitat Management, Preservation, and Restoration Plan (SMP). The SMP is to restore 5,000 to 7,000 acres of managed wetland activities in 30 years. The SMP preserves and enhances 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.

In June of 2013, USFWS issued a BO on the SMP based on the project description that includes program-level tidal wetland restoration of 5,000 to 7,000 acres. An overview of the expected outcomes of tidal restoration is presented, but specific site locations and other details are not included. As sites are identified, and there is sufficient detail about the nature, scope, location, and timing of the restoration actions, the USFWS will review that information. If the site-specific tidal restoration plans are consistent with the SMP and USFWS-issued biological opinions, USFWS will append the project to the PBO and provide an incidental take statement. If a tidal restoration project has potential effects on listed species beyond those analyzed in the PBO, planning efforts for those projects will include site-specific consultation under the ESA with USFWS.

Requirements for proposed tidal marsh restoration project to be appended to the PBO are as follows. The proposed tidal marsh restoration project must:

- Be within the SMP area.
- Not exceed the acreage evaluated in the SMP; Note, this project dos not preclude additional restoration activities from occurring in Suisun Marsh that are not specifically addressed in this BO. Separate environmental permitting would be needed for these projects.
- Follow the SMP site selection considerations.
- Follow the conservation measures and reporting (per the PBO).
- Be reviewed and approved by USFWS and CDFW.
- Be reviewed by the Suisun Adaptive Management Advisory Team and the SMP Principals.

3A.6.1.1.2 Suisun Marsh Salinity Control Gates

The SMSCG are located on Montezuma Slough about two miles downstream from the confluence of the Sacramento and San Joaquin Rivers, near Collinsville. The objective of Suisun Marsh Salinity Control Gate operation is to decrease the salinity of the water in Montezuma Slough. The gates control salinity by restricting the flow of higher salinity water from Grizzly Bay into Montezuma Slough during incoming tides and 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.

When Delta outflow is low to moderate and the gates are not operating, tidal flow past the gate is approximately 5,000 to 6,000 cfs while the net flow is near zero. When operated, flood tide flows are arrested while ebb tide flows remain in the range of 5,000 to 6,000 cfs. The net flow in Montezuma Slough becomes approximately 2,500 to 2,800 cfs. The USACE permit for operating the SMSCG requires that it be operated between October and May only when needed to meet Suisun Marsh salinity standards. Historically, the gate has been operated as early as October 1, although in some years (e.g., 1996) the gate was not operated at all. When the channel water salinity decreases sufficiently below the salinity standards, or at the end of the control season, the project provides unrestricted movement through Montezuma Slough. Details of annual gate operations can be found in *Summary of Salinity Conditions in Suisun Marsh During Water Years* 1984–1992 (California Department of Water Resources 1994), or the Suisun Marsh Monitoring Program Data Summary produced annually by DWR's Division of Environmental Services.

The approximately 2,800 cfs net flow induced by SMSCG operation is effective at moving the salinity downstream in Montezuma Slough. Salinity is reduced by roughly 100 percent at Belden's Landing, and by lesser amounts farther west along Montezuma Slough. At the same time, the salinity field in Suisun Bay moves upstream as net Delta outflow (measured nominally at Chipps Island) is reduced by gate operation. Net outflow through Carquinez Strait is not affected.

The SMSCG are operated during the salinity control season, which spans from October to May. Operational frequency is affected by hydrologic conditions, weather, Delta outflow, tide, fishery considerations, and other factors. The gates have also been operated for scientific studies. After discussions with NMFS based on study findings, the boat lock portion of the gate is now held open at all times during SMSCG operation to allow for continuous salmon passage opportunity. Adaptive management of the gates continues to improve and salinity standards have been met with less frequent gate operation since 2006. In low outflow years gate operation was used from 35 to 42 days. The operation was limited to 17 to 69 days in 2009, 2010, 2011 and 2013. Assuming no significant long-term changes in the drivers mentioned above, it is expected that gate operations will remain at current levels (17 to 69 days per year) except perhaps during the most critical hydrologic conditions and other conditions that affect Delta outflow.

3A.6.1.1.3 SMSCG Fish Passage Study

The SMSCG were constructed and operate under USACE Permit 16223E58, which includes a special condition to evaluate the nature of delays to migrating fish. Ultrasonic telemetry studies in 1993 and 1994 showed that the physical configuration and operation of the gates during the control season have a negative effect on adult salmonid passage (Tillman et al. 1996; Edwards et al. 1996).

The Department coordinated additional fish passage studies in 1998, 1999, 2001, 2002, 2003, and 2004. Migrating adult fall-run Chinook Salmon were tagged and tracked by telemetry in the vicinity of the SMSCG to assess potential measures to increase the salmon passage rate and decrease salmon passage time through the gates.

Results in 2001, 2003, and 2004 indicate that leaving the boat lock open during the Control Season when the flashboards are in place at the SMSCG and the radial gates are tidally operated provides a nearly equivalent fish passage to the non-control season configuration when the flashboards are out and the radial gates are open. This approach minimizes delay and blockage of adult Sacramento River winter-run Chinook Salmon, Central Valley spring-run Chinook Salmon, and Central Valley Steelhead migrating upstream during the Control Season while the SMSCG is operating. However, the boat lock gates may be closed temporarily to stabilize flows to facilitate safe passage of watercraft through the facility.

Reclamation and DWR are continuing to coordinate with the SMSCG Steering Committee in identifying water quality criteria, operational rules, and potential measures to facilitate removal of the flashboards during the control season that would provide the most benefit to migrating fish. However, the flashboards would not be removed during the control season unless it was certain that standards would be met for the remainder of the control season without the flashboards installed.

3A.6.1.1.4 Roaring River Distribution System

The RRDS 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 RRDS 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 the 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 RRDS above the adjacent managed wetlands. Managed wetlands north and south of the RRDS receive water, as needed, through publicly and privately owned turnouts on the system.

The intake to the RRDS is screened to prevent entrainment of fish larger than approximately 25 mm. DWR designed and installed the screens based on CDFW criteria. The screen is a stationary vertical screen constructed of continuous-slot stainless steel wedge wire. All screens have 3/32 inch slot openings. After the listing of Delta Smelt, RRDS diversion rates have been controlled to maintain an average approach velocity below 0.2 ft/s at the intake fish screen. Since 1996, the motorized slide gates have been operated remotely to allow hourly adjustment of gate openings to maximize diversion throughout the tide.

DWR conducts routine maintenance of the system, primarily maintaining the levee roads and fish screens. RRDS, like other levees in the marsh, have experienced subsidence since it was constructed in 1980. In 1999, DWR restored all 16 miles of levees to design elevation as part of damage repairs following the 1998 flooding in Suisun Marsh. In 2006, portions of the north levee were repaired to address damage following the January 2006 flooding.

3A.6.1.1.5 Morrow Island Distribution System

The Morrow Island Distribution System (MIDS) 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 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 MIDS 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 long and the C-Line ditch is approximately 0.8 miles long.

The 1997 USFWS BO issued for dredging of the facility included a requirement for screening the diversion to protect Delta Smelt. DWR and Reclamation are currently analyzing conservation alternatives to a fish screen in coordination with USFWS and CDFW to meet BO requirements.

Studies suggest that Goodyear Slough is a marginal, rarely used habitat for special-status fishes. Therefore, implementing other tidal restoration projects elsewhere may be more beneficial and practical than fish screening. Restoration of tidal wetland ecosystems is expected to aid in the recovery of several listed and special status species within the marsh and improve food availability for Delta Smelt and fish.

There are currently no plans to modify operations.

3A.6.1.2 South Delta Temporary Barriers Project

DWR initiated the South Delta Temporary Barrier Project (TBP) in 1991. Permit extensions under Section 404 of the Clean Water Act were granted in 1996, 2001, 2008 and 2011, when DWR obtained permits to extend the Temporary Barriers Project through 2016. The current TBP PBO issued in 2014 by USFWS to USACE allows for permit issuance for construction and demolition through 2017. This allows the USACE to issue a 5-year 505 permit for the agricultural barriers and Head of Old River Barrier. NMFS issued annual BOs to USACE to provide incidental take coverage for permitting the construction of the TBP in 2011 and 2012. In 2013 a PBO was issued to USACE providing incidental take coverage for permitting through 2017. State permits including the Incidental Take Permit and Streambed Alteration Agreement from CDFW and the 401 Water Quality Certification from the Regional Water Quality Control Board, provide coverage through 2016. The project consists of four rock barriers across south Delta channels. In various combinations, these barriers improve water levels and San Joaquin River salmon migration in the south Delta. The existing TBP consists of installation and removal of temporary rock barriers at the following locations.

- Middle River near Victoria Canal, about 0.5 miles south of the confluence of Middle River, Trapper Slough, and North Canal.
- Old River near Tracy, about 0.5 miles east of the DMC intake.
- Grant Line Canal near Tracy Boulevard Bridge, about 400 feet east of Tracy Boulevard Bridge.
- 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 irrigation season. South Delta Temporary Barriers are operated based on San Joaquin flow conditions. Head of Old River Barrier is only installed from September 16th to November 30th and is no longer installed in the spring months per 2008 USFWS Delta Smelt BO Action 5. Operation of the agricultural barriers at Middle River and Old River near Tracy can begin as early as April 15. 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 out-migrating salmon smolts entering Old River. During the fall, this barrier is designed to improve flow and DO 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 from April 15 to May 15 for the spring, and from early September to late November for the fall. Installation and operation of the barrier at the head of Old River also depends on the San Joaquin River flow conditions.

In addition to permitting construction and removal of the barriers, the permits also give DWR coverage for scientific studies that may take endangered fish species. According to NMFS and USFWS BO requirements, actions for each upcoming year—including barrier type, timing, and any scientific studies planned—must be submitted to the USACE by October 1 of each year. USACE requests of NMFS and USFWS that the actions for the upcoming year be appended to the PBOs.

In 2009 and 2010, an experimental non-physical barrier was installed in lieu of the HOR spring rock barrier with the intention of deterring out-migrating juvenile salmonids from entering Old River. This experimental barrier is a patented technology using sound and light as a deterrent. Although high flows prohibited installation of the non-physical barrier in 2011, a without-barrier study of predator behavior was conducted. In 2012, a rock barrier with eight culverts was installed in the spring as a component of a fish-monitoring study designed to inform export operations. The rock barrier with eight culverts is expected to be installed each spring unless installation is prevented by high flows in the San Joaquin River, or if new studies conclude the spring HOR barrier does not provide salmonid protections previously assumed.

To improve water circulation and quality, DWR in coordination with the South Delta Water Agency and Reclamation, began in 2007 to manually tie open the culvert flap gates at the Old River near Tracy barrier to improve water circulation and untie them when water levels fell unacceptably. This operation is expected to continue in subsequent years as needed to improve water quality. In addition, DWR consulted with USACE and received USFWS and NMFS approval to raise the Middle River weir height by 1 foot. The weir height will be raised during the summer irrigation season only after Delta Smelt concerns have passed. The requested modification was approved late in the 2010 irrigation season. The weir was raised in 2012. It was not raised in 2011 due to high flow conditions in the south Delta.

In the absence of permanent operable gates, the TBP would continue as planned and permitted. Computer model forecasts, real-time monitoring, and coordination with local, state, and federal agencies and stakeholders would help determine if the temporary rock barriers operations need to be modified during the transition period.

3A.6.1.2.1 Conservation Strategies and Mitigation Measures

DWR has complied with the various measures and conditions required by regulatory agencies under past and current permits to avoid, minimize, and compensate for the TBP impacts. An ongoing monitoring plan is implemented each year the barriers are installed and an annual monitoring report is prepared to summarize the activities. The monitoring elements include fisheries monitoring and water quality analysis, salmon smolt survival investigations, barrier effects on SWP and CVP entrainment, Swainson’s Hawk monitoring, water elevation, water quality sampling, and hydrologic modeling. DWR operates fish screens to offset TBP impacts at Sherman Island. Studies of predator behavior in the vicinity of the non-physical barrier began in 2011 as required by CDFW.

The 2008 NMFS BO for the TBP requires a fisheries monitoring program using biotelemetry techniques to examine the movements and survival of juvenile salmon and juvenile steelhead through the channels of the south Delta. The BO also requires that predation effects associated with the barriers be examined. Information gained as part of the 2009 pilot study was used to develop the full scale study that started in 2010. 2011 was the third and final year of the studies mandated in the 2008 BO. Any future telemetry studies at the barriers would be required from a subsequent BO.

The CDFW incidental take permit provides California Endangered Species coverage through 2016. This permit requires 6 acres of shallow water habitat that have been provided through a purchase from the Wildlands Liberty Island mitigation bank.

3A.6.2 Delta-Mendota Canal/California Aqueduct Intertie

The DMC/California Aqueduct Intertie was completed in 2012. The project consists of a pumping plant and pipeline connections between the DMC and the California Aqueduct. The DMC/California Aqueduct Intertie Pumping Plant is located at DMC milepost 7.2 where the DMC and the California Aqueduct are about 500 feet apart.

The DMC/California Aqueduct Intertie achieves multiple benefits, including meeting current water supply demands, allowing for the maintenance and repair of the CVP Delta export and conveyance facilities, and providing operational flexibility to respond to emergencies. The Intertie allows flow in both directions, which would provide additional flexibility to both CVP and SWP operations. The Intertie includes a pumping plant at the DMC that allows up to 467 cfs to be pumped from the DMC to the California Aqueduct. Up to 900 cfs can be conveyed from the California Aqueduct to the DMC using gravity flow.

The DMC/California Aqueduct Intertie is operated by the San Luis and Delta-Mendota Water Authority (Authority). Agreements between Reclamation, DWR, and the Authority identify the responsibilities and procedures during operation of the DMC/California Aqueduct Intertie.

3A.6.2.1 Operations

The DMC/California Aqueduct Intertie can be used under three different scenarios:

- Up to 467 cfs may be pumped from the DMC to the California Aqueduct to ease DMC conveyance constraints and help meet water supply demands of CVP contractors. This would allow Jones Pumping Plant to pump to its design capacity of up to 4,600 cfs, subject to all applicable export pumping restrictions for water quality and fishery protections.
- Up to 467 cfs may be pumped from the DMC to the California Aqueduct to minimize impacts on water deliveries due to temporary restrictions in flow or water levels on the lower DMC (south of the Intertie) or the upper California Aqueduct (north of the Intertie) for system maintenance or due to an emergency shutdown.
- Up to 900 cfs may be conveyed from the California Aqueduct to the DMC using gravity flow to minimize impacts on water deliveries due to temporary restrictions in flow or water levels on the lower California Aqueduct (south of

the Intertie) or the upper DMC (north of the Intertie) for system maintenance or for an emergency shutdown.

The DMC/California Aqueduct Intertie provides operational flexibility between the DMC and California Aqueduct. It would not result in any changes to authorized pumping capacity at Jones Pumping Plant or Banks Pumping Plant.

Water conveyed at the DMC/California Aqueduct Intertie to minimize reductions to water deliveries during system maintenance or an emergency shutdown on the DMC or California Aqueduct can include pumping of CVP water at Banks Pumping Plant or SWP water at Jones Pumping Plant through use of JPOD. In accordance with COA Articles 10(c) and 10(d), JPOD may be used to replace conveyance opportunities lost because of scheduled maintenance, or unforeseen outages. Use of JPOD for this purpose can occur under Stage 2 operations defined in SWRCB D-1641, or could occur as a result of a SWRCB Temporary Urgency request. Use of JPOD in this case does not result in any net increase in allowed exports at CVP and SWP export facilities. When in use, water within the DMC is conveyed to the California Aqueduct via the Intertie to O'Neill Forebay.

3A.6.3 Transfers

California Water Law and the CVPIA promote water transfers as important water resource management measures to address water shortages provided certain protections to source areas and users are incorporated into the water transfer. Parties seeking water transfers generally acquire water from sellers who have available surface water who can make the water available through releasing previously stored water, pump groundwater instead of using surface water; fallow crops or substitute a crop that uses less water in order to reduce normal consumptive use of surface diversions.

Water transfers (addressed in this document) occur when a water right holder within the Sacramento-San Joaquin River watershed undertakes actions to make water available for transfer. The SWP does not address the upstream operations that may be necessary to make water available for transfer. Nor does this document address the impacts of water transfers on terrestrial species.

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 to the buyer. Additionally, Reclamation and DWR must coordinate review of the transfer proposals and Project operations to assure that the Projects are not impacted including the ability to exercise their own water rights or to meet their legal and regulatory requirements are not diminished or limited in any way. To avoid impacts to Delta water quality the individual transfer is assessed a carriage water loss to account for flows required to avoid impacts to Delta water quality or flow objectives. All transfers would be in accordance with all existing regulations and requirements.

Purchasers of water for transfers may include Reclamation, CVP water contractors, DWR, SWP water contractors, other State and Federal agencies, and other parties. Reclamation and DWR have operated water acquisition programs in the past to provide water for environmental programs and additional supplies to CVP water contractors, SWP water contractors, and other parties. Past transfer programs include the following.

- DWR administered the 1991, 1992, 1994, and 2009 Drought Water Banks and Dry Year Programs in 2001 and 2002.
- Reclamation operated a forbearance program in 2001 by purchasing CVP contractors' water in the Sacramento Valley for CVPIA instream 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 instream flows.
- DWR is a signatory to the Yuba River Accord Water Transfer Agreement through 2025 that provides fish flows on the Yuba River and also water supply that is exported at DWR and Reclamation Delta facilities for the CVP and SWP operations and for the SWP and CVP contractors.
- In the past, CVP contractors and SWP water contractors have independently acquired water and arranged for pumping and conveyance through SWP and CVP facilities.

3A.6.3.1 Lower Yuba River Accord

The Lower Yuba River Accord (Yuba Accord) consists of three sets of agreements designed to protect and enhance fisheries resources in the Lower Yuba River, increase local water supply reliability, provide DWR with increased operational flexibility for protection of Delta fisheries resources, and provide added dry-year water supplies to CVP and SWP water contractors. These agreements are:

- The Lower Yuba River Fisheries Agreement (Fisheries Agreement).
- Agreements for the Conjunctive Use of Surface and Groundwater Supplies (Conjunctive Use Agreements).
- Agreement for the Long-term Purchase of Water from Yuba County Water Agency by DWR (Water Purchase Agreement).

The Fisheries Agreement is the cornerstone of the Yuba Accord. It was developed by state, federal, and consulting fisheries biologists, fisheries advocates, policy representatives, and the Yuba County Water Agency (YCWA). Compared to the interim flow requirements of the SWRCB Revised Water Right Decision 1644 (RD-1644), the Fisheries Agreement establishes higher minimum instream flows during most months of most water years.

To assure that YCWA's water supply reliability is not reduced by the higher minimum instream flows and water transfers, it and seven of its member units have signed conjunctive use agreements. These agreements establish a conjunctive use program that facilitates the integration of the surface water and groundwater supplies of the seven local irrigation districts and mutual water companies that YCWA serves in Yuba County. Integration of surface water and groundwater allows YCWA to increase the efficiency of its water management.

Under the Water Purchase Agreement, DWR administers the water transfer activities. The Water Transfer Agreement allows DWR to purchase water from YCWA to generally offset water costs resulting from export restrictions in winter and spring each year to benefit Delta Smelt and out-migrating San Joaquin River salmonids. This quantity of water is known as "Component 1 Water" under the Water Purchase Agreement and is quantified as the first 60 TAF of surface water above a defined baseline that Yuba releases each year. Assuming a 20 percent carriage water cost, approximately 48 TAF would reach the export pumps to produce a mitigation offset of approximately 48 TAF of reduced exports.

Additional water supplies purchased by the SWP water contractors and/or CVP contractors under the Water Purchase Agreement are administered by DWR as a water transfer program in drier years. These supplies include: (a) Component 2 water (15 TAF per year [TAF/yr] in Dry Years and up to 30 TAF/yr in Critical Years); (b) Component 3 water (up to 40 TAF/yr in specified lower SWP or CVP allocation years); and (c) Component 4 water (additional water that YCWA makes available from surface-water supplies and its groundwater substitution program). The San Luis and Delta-Mendota Water Authority is a Participating Contractor to provide benefits to certain of its member CVP contractors.

CEQA review for all of the Yuba Accord agreements (Fisheries, Water Purchase, and Conjunctive Use) was completed in 2007 and these agreements were fully executed between late 2007 and early 2008. SWRCB approved the instream flow schedules and water transfer aspects of the Yuba River Accord, with some corrections, on March 18, 2008. The Fisheries Agreement will terminate when FERC issues a new long-term FERC license for the Yuba River Development Project (which will be sometime after April 30, 2016 when the present license expires). The Water Purchase Agreement will terminate on December 31, 2025, but the amounts of water that YCWA will transfer under the agreement after FERC issues a new long-term license for the Yuba River Development Project will be subject to negotiation by the parties to the agreement. The Conjunctive Use Agreements will terminate when the Fisheries Agreement and Water Purchase Agreement terminate. It is assumed in this EIS that the existing or similar agreements will be renewed by 2030.

3A.6.3.2 Transfer Capacity

It is expected that water transfer programs for environmental and water supply augmentation will continue in some form, and that in most years (all but the driest), the scope of annual water transfers of water exported through the Delta will be limited by available Delta pumping capacity, and exports for transfers will be limited to the months of July-September. As such, looking at an indicator of available transfer capacity in those months is one way of estimating an upper boundary to the effects of transfers on an annual basis.

The CVP and SWP may provide Delta export pumping for transfers using pumping capacity at Banks and Jones pumping plants beyond that which is being used to deliver Project water supply, up to the diversion capacity, consistent with existing operational and regulatory restrictions.

The surplus capacity available for transfers varies a great deal with hydrologic conditions. In general, as hydrologic conditions get wetter, surplus capacity diminishes because the CVP and SWP are more fully using export pumping capacity for Project supplies. The CVP's Jones Pumping Plant has little surplus capacity, except in the driest hydrologic conditions. The SWP has the most surplus capacity in critical and some dry years, less or sometimes none in most median hydrologic conditions, and some surplus again in some above normal and wet years when demands may be lower because some water users may have alternative supplies.

The availability of water for transfer and the demand for transferred water may also vary with hydrologic conditions. Accordingly, since many transfers are negotiated between willing buyers and sellers under prevailing market conditions, price of water also may be a factor determining how much is transferred in any year. This document does not attempt to identify how much of the available and useable surplus export capacity of the CVP and SWP would actually be used for transfers in a particular year, but given the recent history of water transfer programs and requests for individual water transfers, trends suggest a growing reliance on transfers to meet dry year water demands.

Under both the present and future conditions, capability to export transfers would often be capacity-limited, except in Critical and some Dry years. In Critical and some Dry years, both Banks and Jones pumping plants would likely have surplus capacity for transfers. As a result, export capacity is less likely to limit transfers in these years. During such years, low Project exports and high demand for water supply could make it possible to transfer significant amounts of transfer water when upstream water supplies are available.

3A.6.4 Proposed Exports for Transfers

Although transfers may occur at any time of year, the 2008 USFWS BO and 2009 NMFS BO address proposed exports for transfers during only the months July through September. For transfers outside those months, or in excess of the maximum amounts (listed below), separate consultations would be required with the USFWS and NMFS. Based on the estimates of available capacity for export of transfers during July through September, and in recognition of the many other possible operational contingencies and constraints that may limit actual use of that capacity for transfers, as follows.

- Critical Water Year: Maximum Transfer Amount is 600 TAF
- Dry Water Year following Critical Water Year: Maximum Transfer Amount is 600 TAF
- Dry Water Year following Dry Water Year: Maximum Transfer Amount is 600 TAF
- All Other Water Years: Maximum Transfer Amount is 360 TAF

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