Appendix 1A
Primer on the Delta and California Water Delivery Systems

The Sacramento-San Joaquin Delta (Delta or Bay Delta) is a region where two of California's largest rivers meet. Freshwater from the rivers mingles with saltwater from the Pacific Ocean, creating the West Coast's largest estuary. When first explored by the Spanish in the 1770s, the Delta was a vast marsh covered with tules and teeming with wildlife. Today the Delta is a highly engineered environment, composed of 57 leveed island tracts and 700 miles of sloughs and winding channels.

The watersheds for the Sacramento and San Joaquin Rivers and the Delta serves a number of competing uses. They provide water for much of California. They also provide rich and productive habitat for more than 500 species of fish and wildlife and support a number of endangered species. Railways, highways, and utilities crisscross the Delta, and ships traveling up and down deepwater channels to Sacramento and Stockton transport millions of tons of cargo to busy ports. The Rivers and the Delta also provide significant recreational opportunities.

Over decades, physical, biological and chemical alternations have occurred. Delta channels have been widened, straightened, deepened, connected, leveed, and gated. Rivers have been dammed and flows manipulated. Hydraulic mining has had lasting effects on sediment dynamics. Non-native and invasive species have been introduced and become established. Agriculture, industry, and municipalities use the Rivers and the Delta to discharge and remove runoff. Many of these changes have contributed to the Delta's decline as a natural estuary.

The BDCP is not intended solve all of these problems or to address all of the factors that have contributed to the Delta's decline. The scope of the BDCP is within the Delta itself with a specific purpose to restore and protect its ecosystem health, SWP and CVP water supply, and water quality within a stable regulatory environment. Other efforts, particularly the Delta Plan, are focused on the broader interests and issues currently facing the Delta region as a whole.

This appendix provides background on the Delta and its development, the many issues facing the Delta, and other past and present efforts to address the Delta's many problems to provide context for the relatively narrow scope and purpose of the BDCP.

1A.1 The Sacramento–San Joaquin Delta

1A.1.1 Today's Delta

The Sacramento–San Joaquin River Delta, or California Delta, is an expansive inland river delta and estuary in northern California. The Delta is formed at the western edge of the Central Valley by the confluence of the Sacramento and San Joaquin Rivers, and lies just east of where the rivers enter Suisun Bay. The rivers' combined fresh water flows roll through the Carquinez Strait, a narrow break in the Coast Range, and into San Francisco Bay's northern arm. Suisun Marsh and adjoining bays are the brackish transition between fresh and salt water. The city of Stockton is located on the San Joaquin River on the eastern edge of the Delta. Portions of six counties—Alameda, Contra Costa, Sacramento, San Joaquin, Solano, and Yolo—make up the Delta. Figure 1A-1 shows the outline of the legally defined (statutory) Delta.

The Delta consists of a myriad of small natural and artificial channels (called sloughs), creating a system of isolated lowland islands and wetlands defined by dikes or levees. The islands in the Delta are not islands in the classic sense, but are referred to as such because they are completely surrounded by water and in many cases are so isolated that they are accessible only by boat, ferry, or aircraft. An extensive system of earthen levees has allowed widespread farming throughout the Delta. Its peat soil makes it one of the most fertile agricultural areas in California and arguably even the nation, contributing billions of dollars to the state's economy. Certain specialty crops, such as asparagus, are grown in the Delta in quantities unmatched anywhere else in the United States.

The Delta is crucial to the state's overall water picture. It is the heart of California's two largest surface water delivery projects, the State Water Project (SWP) and the Central Valley Project (CVP). Since the 1940s, its existing channels have been used to transport water to the projects' pumps in the western and southwestern Delta. From there, Delta water is transported south and west through canals and aqueducts to cities in the Bay Area, millions of acres of San Joaquin Valley farmland and more than 25 million people in southern California. Two-thirds of the state's residents rely on the Delta for at least a portion of their drinking water.

The Delta is also an important fishery habitat. An estimated 25% of all warm water and anadromous sport fishing species and 80% of the state's commercial fishery species live in or migrate through the Delta. Substantial runs of anadromous fish—salmon, steelhead, and sturgeon—once migrated up the Sacramento and San Joaquin Rivers to spawn. The surrounding waterways serve as passageways for 130 fish species that call the estuary home.

Additionally, the Delta provides valuable habitat for a wide variety of wildlife, with 380 types of animals residing within the ecosystem. Birds make up the majority of wildlife species, as the estuary offers important wintering habitat for millions of traveling ducks and geese. Amphibians, reptiles and mammals also are found within the estuary.

The Delta is a popular recreational spot in the state. Its islands offer camping, hiking, sightseeing, bicycling, hunting and horseback riding, while Delta channels offer boating, water-skiing and fishing. All these recreational activities contribute to the local economy, but they also increase pressure on the already fragile estuary.

1A.1.2 Changes in Delta Conditions

The Delta has undergone significant physical and biological modifications over the past 150 years, including the reclamation of 700,000 acres of tidal marsh and adjoining floodplains, as well as significant changes in riverine and tidal hydrology, and water quality (Moyle et al. 2010). Habitats for Delta native fishes have changed dramatically as a result of changes in hydrologic patterns from dams and water diversions, upstream land use changes, tidal marsh reclamation, and channelization of rivers and tidal channels (Moyle et al. 2010). As a result, the estuary is now one of the most highly modified and controlled estuaries in the world, having lost much of its variability and complexity (Moyle et al. 2010). In addition, there have been continual invasions of nonnative species and large changes in water quality from pollution and upstream diversions of fresh water (Moyle et al. 2010). These changes have caused the decline and extinction of native biota of the Delta, most notably some fishes, and maintains an environment that is increasingly hostile to native species (Moyle et al. 2010).

Historic fisheries in the Bay-Delta included salmon, steelhead trout, sardines and herring. Commercial fisheries were established for salmon, smelt, sole, flounder, sardine, herring and anchovy. In the 1800s, there were few controls on these fisheries, and in time, over-fishing contributed to declines in native species. Early settlers responded to these declines by introducing new species such as American shad and striped bass, both of which supported commercial fisheries for many years. To mitigate for the impacts caused by construction of dams and/or to boost dwindling salmon runs, a number of fish hatcheries were established. However, fish populations continued to decline, leading eventually to commercial fishing bans on white sturgeon, steelhead trout, striped bass and American shad. Central Valley fall-run Chinook salmon tentatively still support commercial fisheries but commercial and recreational fishing has been restricted or completely closed in recent years due to population declines. Today the Delta is a highly altered ecosystem which supports an assemblage of primarily alien species that thrive in fairly clear, warm, fresh water with strong tidal fluxes (Moyle et al. 2010). The aquatic habitat in the Delta has become simplified into a system of rip-rapped canals, cross hatched by navigation cuts that convey fresh water for export from and through the Delta during summer and which reduce outflows at other times of the year (Moyle et al. 2010). The demand for low salinity water and altered hydrology to support pumping operations has reduced the variability in salinity during the critical summer months, favoring the expansion of ecosystem-altering species such as overbite clam in Suisun bay and Brazilian waterweed in the Delta (Moyle et al. 2010). Nonnative freshwater species such as largemouth bass have increased dramatically and dominate Delta food webs while at the same time native species have collapsed (Moyle et al. 2010). There are other factors which affect the native Delta fish, including contaminants such as artificial hormones, reduced invertebrate food supply, altered food webs, disease, harmful algae blooms, lack of tidal marsh and floodplain habitat, and the change in Delta hydraulics caused by pumping for water for export from the South Delta (Moyle et al. 2010).

The extensive development of the SWP and CVP infrastructure in California has altered both the temporal and spatial distribution of Delta water through installations of water diversions, levees, pumps, and flow-altering barriers. Control of river flow and stage through the operation of SWP and CVP dams and water transfer facilities has reduced the winter and spring floods into the Delta, while maintaining elevated flows in the summer and late fall periods (National Marine Fisheries Service 2009). These seasonal flows influence the transport of eggs and young organisms through the Delta and into San Francisco Bay, playing an important role in the reproductive success and survival of many estuarine species including salmon, striped bass, American shad, delta smelt, longfin smelt, splittail, sturgeon and others (Bureau of Reclamation 2011). Temporal variations in freshwater flow are hypothesized to be the most important natural factor influencing the Delta ecosystem (CALFED 2008).

In addition, long-term future trends predict increased water clarity, increased nonnative species introductions, altered spatial and temporal habitat availability, altered food webs, and decreased abundance of fish in the northern Delta estuary and pelagic (open water) environments (CALFED 2008). As a result, the hydrologic state of the Delta no longer reflects environmental conditions to which many native Delta organisms are adapted.

1A.2 Issues Affecting the Delta Today

There are a myriad of environmental stressors affecting the Delta, from nonnative species to upstream pollution. In addition, there are a number of other issues that affect how the Delta functions are managed. The following section provides a brief overview of some of the major issues facing the Delta today.

1A.2.1 Demands on Water Supply

With the construction of the CVP and SWP, the Delta became a critical link in the state's complex water distribution system. Valley rivers and Delta channels transport water from upstream reservoirs to the South Delta, where state and federal facilities (the Harvey O. Banks Delta Pumping Plant and the Jones Pumping Plant) pump water into the California Aqueduct and CVP canals. The Delta is a conduit for water that is used for a wide range of in-stream, riparian, and other beneficial uses, including: critical habitat for several native aquatic and terrestrial species; drinking water for more than 25 million people in Central and Southern California and portions of the Bay Area; and irrigation water for 4 million acres of irrigated farmland throughout the Delta and San Joaquin Valley.

The water balance within the Delta—that is, the comparison of total inflows to total outflows—is controlled by supply from the Sacramento and San Joaquin rivers, eastside rivers and streams (Mokelumne and Cosumnes rivers), contributions from Coast Range watersheds, upstream diversions, demand from in-Delta users, outflows from the Delta to the San Francisco Bay and Pacific Ocean, and exports to agricultural and municipal and industrial (M&I) users outside of the Delta. In-Delta precipitation and storage and periodic tributary inflows provide additional water supplies to the Delta but are minor compared with the river water contributions. The largest system outflow is the portion of inflow that travels through the Delta, contributes to in-channel and wetland habitats, and exits through the San Francisco Bay to the Pacific Ocean. The second largest outflows are exports through the SWP and the CVP, followed by in-Delta use and local diversions.

There are over 3,000 diversions that remove water from upstream and in-Delta waterways for agriculture and M&I uses. Of these, 722 are located in the mainstem San Joaquin and Sacramento rivers and 2,209 diversions are in the Delta (Herren and Kawasaki 2001). In the Delta, the SWP and CVP use the Sacramento and San Joaquin rivers and other Delta channels to transport water from river flows and reservoir storage to two water export facilities in the South Delta (i.e., the Jones Pumping Plant and the Banks Pumping Plant). Water from these facilities is exported for urban and agricultural water supply demands throughout the San Joaquin Valley, Southern California, the Central Coast, and the southern and eastern San Francisco Bay Area. Of the over 2,200 water diversions in the Delta, most are unscreened and used for in-Delta agricultural irrigation (Herren and Kawasaki 2001). Additionally, water from industrial diversions at Pittsburg and Antioch provide cooling for generators producing electric power at the Mirant Delta LLC (Mirant) power plants.

In the past decade, California's population experienced a 25% growth rate, double the national average. State officials in the California Department of Finance estimate the State's current population of 37 million will exceed 52 million by 2030 and reach nearly 60 million by 2050. In its 2009 update of the California Water Plan, DWR used three possible scenarios of future conditions to forecast water demands up to the year 2050, which ranged to as high as 10 million af per year.

In addition to the demands placed upon water from the Delta as a result of California's growing population, water projects must meet operational requirements including those within biological opinions of federal regulatory agencies for the protection of certain fish and wildlife species, and those for D-1641, with critical life stages that depend on freshwater flows. Meeting these Delta water operational requirements has resulted in an overall reduced and less flexible water supply.

With forecasts of reduced precipitation, shifts in timing of peak flow and runoff periods, reductions in snowpack, and impacts from sea level rise as a result of global climate change, the struggle to meet these divergent demands will be magnified in the future. Even so, the California Legislature has been clear that the Delta remains "the hub of the California water system, as [t]he economies of major regions of the state depend on the ability to use water within the Delta watershed or to import water from the Delta watershed." Specifically, "[m]ore than two-thirds of the residents of the state and more than two million acres of highly productive farmland receive water exported from the Delta watershed" (California Public Resources Code (PRC), §§ 85002, 85004).

1A.2.2 Delta Salinity

With rivers feeding into it and marine bays at its western edge, the Delta is the junction for seawater and fresh water within the wider estuary system. As such, salinity levels fluctuate daily and seasonally, depending on the elevation of tides and magnitude of freshwater inputs, respectively (CALFED 2008). Prior to human intervention, salty ocean water from the San Francisco Bay invaded the Delta during dry summers when mountain runoff ebbed. Then, during the winter, heavy runoff from the mountains could expel sea water from the Delta and even the Bay. Historical accounts show that the location of where saltwater transitioned to fresh water was largely dependent upon the dryness of the year. A wet year resulted in a substantially fresh water San Francisco Bay; whereas, a severe drought allowed salt water to move inland, as far as Sacramento.

Natural salinity levels have been altered within the Delta through the use of various gates and barriers, as well as locations and operations of export facilities and upstream reservoirs, which together may influence many of the native aquatic organisms within the Delta estuary. As reservoir releases changed the timing of flows and exports have increased from historic conditions, Delta salinity has decreased, creating less than optimal environmental conditions for native species and often favoring nonnative species (Lund et al. 2008). Water management has had a similar effect on water quality as observed by the reduced variability of freshwater flow, such that salinity conditions have become more constant (Lund et al. 2008).

Delta salinity has been a major concern since the City of Antioch's 1920 lawsuit against irrigators in the Sacramento Valley, whose upstream water withdrawals reduced freshwater flows into the Delta and increased the salinity at water intakes in the western Delta. Salinity affects the use and taste of urban water supplies, the productivity of farmland, and the viability of different organisms within aquatic ecosystems. For many decades, this issue was discussed in terms of where the salinity gradient—that is, the transition from seawater to freshwater (referred to as X2 by scientists)—should be located in the estuary. Since the 1920s, to meet water supply needs, it has been regarded as desirable to maintain the Delta, as much as possible, as a freshwater system, Suisun Bay and Marsh as brackish water systems, and San Francisco Bay as a marine (saltwater) system. SWP and CVP reservoirs are operated in part to alleviate the problem of seasonal salt water intrusion into the Delta by making releases of fresh water year-round. However, salinity intrusion from the ocean or accumulation of minerals from farming discharges into Delta rivers remains a problem. Increasingly, it has been recognized that salinity and other, broader, water quality problems in the Delta are compounded by the quality of upstream and in-Delta drainage, with consequences for both urban and agricultural users as well as for fish and wildlife.

Agricultural drainage (or in-Delta drainage) also contributes to the Delta's salinity problems. Because most Delta islands are below sea level, water from surrounding channels seeps through the levees onto the land. Farmers must pump this water from their lands while adding controlled amounts of fresh water needed for productive agriculture. In the south Delta, where farmers rely primarily on the waters of the San Joaquin River for their irrigation supply, the process of irrigation concentrates salts in the drainage water, which is then pumped into nearby Delta channels. When the current is not sufficient to "flush" these salts through the Delta, there can be localized salinity problems.

The salt content of drainage water flowing down the San Joaquin River, primarily from the west side of the valley, is high, and sources of dilution water are limited. Most of the valley averages less than 10 inches of rain per year, and fresh water from Sierra tributaries is either exported or diverted for consumptive uses. Flows in some stretches of the San Joaquin River during the summer irrigation season consist almost entirely of these irrigation return flows. In turn, salty return flows increase the salt content of water used downstream by Delta farmers and the amount of salty water flowing into the estuary. Over the last decade, steps have been taken to reduce the volume of agricultural drainage flow into the San Joaquin River.

Salinity is a critical component of the Delta, having broad impacts on the quality of water in the Delta available for drinking, agriculture, and biological resources use. Salinity concentrations are not uniformly distributed throughout the Delta because of the complex interactions between tidal and freshwater inputs that are subject to spatial and temporal variability.

A detailed discussion of salinity and its effects on the aquatic ecosystem in the Delta is provided in EIR/EIS Chapter 8, *Water Quality*, and Chapter 11, *Fish and Aquatic Resources*.

1A.2.3 Water Quality

Because the Delta is a source of drinking water for more than 20 million Californians, the quality of this water is very important. Cycling of nutrients, carbon, and other organic and inorganic materials are some of the major chemical processes driving the ecological conditions of the Delta. Water quality impacts on Delta ecosystems date back to the Gold Rush era when hydraulic mining washed large amounts of sediment from surrounding landforms into the Delta's major tributaries. In addition, hundreds of organic and inorganic toxins are present in the Delta system and may cause adverse physiological responses in humans, plants, fish, or wildlife (Hinton 1998; California Department of Fish and Game 2010). These contaminants—organic, inorganic, and biological pathogens—are found in many forms and have the ability to affect the ecosystem in many ways and at different life stages of individual species.

More specifically, the contaminants present in the Delta include: metals, such as mercury (and methylmercury) and selenium; pesticides; inorganic nutrients (e.g., forms of nitrogen, ammonia, and phosphorus); organic matter; and pharmaceuticals (CALFED 2008). These contaminants may cause acute toxicity, such as mortality, or chronic toxicity, such as reduced growth, reproductive impairment, or other subtle effects. Contaminants can also affect the sustainability of healthy aquatic food webs and interdependent fish and wildlife populations (CALFED 2000). Some contaminants are naturally occurring at low levels, but with human disturbance, contaminants can be present in amounts or concentrations high enough to pose life-threatening effects.

The following are the principal sources that affect water quality in the Delta:

- Historical drainage and sediment discharged from upstream mining operations in the late 1800s and early 1900s contributed metals such as cadmium, copper, and mercury.
- Stormwater runoff can contribute metals, sediment, pathogens, organic carbon, nutrients, pesticides, dissolved solids (salts), petroleum products, and other chemical residues.
- Industrial and municipal wastewater treatment plant discharges can contribute salts, metals, trace organics, nutrients, pathogens, pesticides, organic carbon, and oil and grease.
- Agricultural irrigation return flows and nonpoint discharges can contribute salts (including bromide), selenium, organic carbon, nutrients, pesticides, pathogens, and sediment.
- Water-based recreational activities (such as boating) can contribute hydrocarbon compounds, nutrients, and pathogens.
- Atmospheric deposition can contribute metals, nutrients, pesticides, and other synthetic organic chemicals, and may lower pH.
- Seawater intrusion can contribute salts, including bromide, which affect total dissolved solids concentrations and can contribute to the formation of unwanted chemical byproducts in treated drinking water.

The length of time during which nutrients and contaminants are present is another important aspect of water quality contamination because of the potential for resident organisms' increased exposure and subsequent chronic effects. Delta sloughs are particularly susceptible because of their longer water residence time before flows move the water through the system.

Recently the U.S. Environmental Protection Agency (EPA) identified the water quality stressors it believes are the most significant, individually and/or cumulatively, for aquatic species health in the Delta estuary (*Water Quality Challenges in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: EPA's Action Plan*, August 2012). The EPA's list of water quality contaminants includes selenium, ammonia, pesticides, and Contaminants of Emerging Concern (U.S. Environmental Protection Agency 2012, Appendix I, p. 1).

As described by the EPA, aquatic life toxicity caused by total ammonia nitrogen is one of the suspected contributors to the pelagic organism decline in the Delta, monitoring data, laboratory testing, and multi-year field observations indicate that concentrations of total ammonia nitrogen in Delta waterways may be toxic to desirable algae species and invertebrates which are significant food sources for pelagic fish. Depressed algal populations and primary productivity is also caused by light limitation and clam grazing in the Bay Delta Estuary. Total ammonia nitrogen levels in Bay Delta waterways may also preferentially support an aquatic ecosystem community composed of toxic blue green algae and jelly fish.

1A.2.4 Suspended Sediments

Suspended sediments are a natural component of the Delta and are not inherently toxic, but have direct as well as indirect impacts on the Delta ecology. The Delta was created as a result of sediment deposition from the Sacramento and San Joaquin Rivers entering the ocean. Many of the species in the Delta have adapted to these highly turbid conditions. Over the last three decades, water in the Delta has become less turbid due to a variety of physical and biological changes.

For instance, construction of upstream dams has reduced the inflow of sediments to the downstream Delta. Levees and other flood management activities have also reduced the amount of sediments transported in the rivers because these facilities are designed to reduce erosion; therefore, turbidity in the river is reduced. The increase of invasive, aquatic weeds also results in areas of reduced mobilization of sediments. These reductions of intertidal mud and sand has reduced the availability of critical habitat for a variety of organisms such as mudworms and waterfowl, as well as increased the potential to uncover and mobilize previously buried contaminants such as mercury and selenium. The resulting decreased turbidity alters the natural system in the Delta by increasing light penetration, altering primary production, and affecting predator-prey interactions through increased water transparency and susceptibility to predation pressure (CALFED 2008; U.S. Fish and Wildlife Service 2008).

Additional information regarding water quality and specific impacts to fish and aquatic resources can be found in EIR/EIS Chapter 8, *Water Quality* and Chapter 11, *Fish and Aquatic Resources*.

1A.2.5 Delta Levees

The Delta is an integral part of the Sacramento and San Joaquin Valley River natural conveyance systems. It receives runoff from 40 percent of the State's land. This system has been extensively modified to redirect and deliver part of the water to meet the needs of two-thirds of the State's population and irrigate millions of acres of farmland. Today, over 1,100 miles of levees protect the 738,000 acres of Delta islands, tracts and population centers from flooding, as well as protecting a large portion of the State's water supply. See Figure 1A-2. The levee systems have allowed farmers to drain and reclaim a large portion of the Delta from its original state as a tidal marsh. These levees were built to prevent flooding and allow cultivation of the rich soil, while protecting towns and cities as well as public infrastructure such as highways, railroads and pipelines.

A sound, well-maintained, levee system is vital to protect not only the farms and towns and transportation corridors on Delta islands, but also the supply of fresh water moving through Delta waterways. When levees fail, water rushes into the lower-than-sea-level islands, pulling salt water from the bay into the Delta. If numerous levees were to fail simultaneously in the Delta, there is a significant risk that large amounts of salt water could flow into the Delta and raise salinity levels. The resulting high salinity levels could require the shutdown of the export pumps in the Delta that supply water to millions of people.

A majority of the levees protecting the Delta (approximately 65 percent) are not within the federal/state Sacramento Flood Control Project system and are constructed and maintained by island landowners or local reclamation districts. These levees are generally built to an agricultural standard and may be somewhat less stable than those constructed and maintained to protect urban areas. Improvement and maintenance of these "non-project" levees can be very challenging. The natural peat deposits that made the Delta such a fertile farming location make poor building materials for levees and/or their foundations. Oxidization of these peat soils has led to island and levee subsidence, which has increased the burden on the levee system. Another way that the Delta levees are distinguished from levees along rivers such as the Sacramento is that they are constantly exposed to water, making them more comparable to dams. However, unlike dams, they are not constructed or regulated to the same high engineering standards. Delta levees need to withstand the daily cycle of tides, wind and boat wakes. Levees in the west Delta receive the strongest impact from tidal influences; soils there are the least stable and most susceptible to liquefaction. Burrowing animals further threaten levees, because they burrow and weaken levees before they are detected.

Additionally, land subsidence, sea level rise, and changes in climate make Delta levees increasingly vulnerable to failure from earthquakes, floods, and other causes. Our understanding of the Delta's vulnerability to natural disaster has been highlighted by recent scientific analysis, which calculated the probability of levee failure due to flooding or earthquake, and by real-world events such as Hurricane Katrina and the 2011 earthquake and tsunami in Japan. These events demonstrated the level of destruction that can result from breached levees. Although levee vulnerability in the Delta is not easy to quantify, it is estimated that levee breaches are very likely in the event of an earthquake.

Since 1980, 27 Delta islands have been partially or completely flooded, including a "sunny-day failure" in June of 2004 at Upper Jones Tract. The levee gave way unexpectedly without any apparent impetus. When pump-out operations began a month later, approximately 140,000 af of water covered the 12,000 acres of Upper and Lower Jones Tracts to an average depth of about 12 feet. DWR estimated total costs related to the levee break at about $90 million, including approximately $45 million in direct flood fighting and levee-repair costs, and millions more in losses of crops and property. A levee break near Isleton, in June of 1972, allowed large volumes of brackish water from San Francisco Bay to rush into the Delta, curtailing state and federal export operations. Approximately 300,000 af of fresh water was released from upstream reservoirs to help flush the intruding salt water out of the Delta.

Repairing the levee damage caused by a natural disaster such as a large earthquake or major flooding could take years, if it could be completed at all, given the cost. Widespread flooding could force a long-term shutdown of the SWP/CVP pumps that keep much of California supplied with water.

Currently, the State has several programs in place to help manage risk and improve the environment in the Delta. Local reclamation districts are responsible for maintaining their levees, but they may be reimbursed for a portion of the costs of their work under the State's Delta Levees Subvention Program established in 1973. The Delta Flood Protection Fund Act of 1988 significantly increased reimbursement opportunities. Another State program, the Delta Levee's Special Project program, provides financial assistance to local levee maintaining agencies for rehabilitation of levees in the Delta. Since the inception of the program, more than $100 million has been provided to local agencies in the Delta for flood control and related habitat projects. The State is also working to manage the risk through emergency response and preparedness. For instance, DWR has been stockpiling materials in key Delta locations for emergency repairs and flood fighting activities. DWR is also working with CalEMA, the United States Army Corps of Engineers and local agencies to coordinate efforts in planning for emergencies. Additional State programs to reduce risk and enhance the Delta include: subsidence control/reversal, beneficial use of dredge material, habitat enhancement and on-going levee evaluations.

In addition to levee construction and repair, there are several major planning efforts currently in development to further maintain and enhance this critical resource. The Delta Stewardship Council is an independent agency of the State and is charged to "develop, adopt, and commence implementation of the Delta Plan," a comprehensive, long-term, management plan for the Delta. The Delta Protection Commission developed its *Land Use and Resource Management Plan for the Primary Zone of the Delta* (Delta Protection Commission 2010) in 2010. This plan contains policies to guide local government uses for the Delta including policies for levees. Outside of the State, the federal government has eight distinct ongoing studies involving the Delta.

1A.2.6 Land Subsidence in the Delta

An issue that has increased in importance over time is the subsidence of Delta lands. A large portion of the Delta lands now lie 25 feet or more below sea level and below the level of the water in the surrounding channels. See Figure 1A-3. In many cases, the reclamation of the islands initiated the subsidence process, because much of the material used to elevate the levees was taken from the interior of reclaimed islands, thereby lowering the island while elevating its protective barrier. Another cause of the subsidence is the soil itself. The peat soils are rich in nutrients, but oxidize as they decompose, releasing carbon dioxide and causing the exposed land to subside as much as 3 inches per year.

Soil burning, mostly associated with the potato farming that developed by 1900, also accounted for much early subsidence. Despite the benefits of burning—weed control, fertilization, and the facilitation of the seedbed—it accelerated subsidence and allowed for salt accumulation and increased wind erosion.

Land subsidence is a critical problem because the process puts additional stress on levees and renders the system of Delta levees unstable, creating a greater likelihood of levee failure and subsequent flooding. In the event of a levee failure, land subsidence would result in greater saltwater intrusion into the Delta.

Additionally, subsidence adds to farming costs because it requires additional levee rebuilding, drainage excavation, and pumping both for regular operations and recovery after floods. However, in general, Delta farmers have continued to farm subsided lands. Even though some of the more destructive farming practices have ceased, slowing down the rate of subsidence, Delta islands continue naturally to subside due to the exposed peat soils.

1A.2.7 Pelagic Organism Decline

The four primary pelagic (open water) fish of the upper Delta (delta smelt, longfin smelt, striped bass and threadfin shad), have shown substantial variability in their populations, with evidence of long-term declines for these species (Baxter et al. 2008). By 2004, these declines became widely recognized and discussed as a serious management issue, and collectively became known as Pelagic Organism Decline (POD). Concerns surrounding POD focus on the fish species that rely on the pelagic zone for spawning, early life history, and perennial habitat. The apparent simultaneous declines of these four fish species occurred despite differences in their life histories and in how each species utilizes Delta habitats. These differences suggested one or more Delta-wide factors to be important in their declines (Baxter et al. 2008).

A multi-agency work team was created in 2005 to evaluate the potential causes of POD, which likely include a combination of factors: stock-recruitment effects, a decline in habitat quality, increased mortality rates, and reduced food availability from invasive species competition. The team organized an interdisciplinary effort that included scientists from DWR, California Department of Fish and Wildlife (CDFW), Central Valley Regional Water Quality Control Board (RWQCB), Reclamation, U.S. Environmental Protection Agency (USEPA), U.S. Geological Survey (USGS), California Bay-Delta Authority, San Francisco State University, and University of California at Davis. A conceptual model, including a suite of 47 studies, was developed to aid in the evaluation of POD, and to describe possible mechanisms by which a combination of long-term and recent changes in the ecosystem could produce the observed pelagic fish declines (Baxter et al. 2008). The conceptual model is intended to assess how different stressors may be linked to the POD, and is based on classical food web and fisheries ecology. It contains four major components: (1) prior fish abundance; (2) habitat; (3) top-down effects; and (4) bottom-up effects (Baxter et al. 2008). A substantial synthesis effort is also included in the model to produce, among other outputs, life cycle models for each of the primary species.

1A.2.8 Fish Entrainment

Freshwater diversions in the Delta range from small pumps and siphons that serve individual farms to the state and federal facilities in the North and South Delta that are used to export water. These facilities directly affect Delta fish species through entrainment and impingement and related mortality. Export pumping and the associated alterations to the movement of water through the Delta may be responsible, in part, for declines of species such as striped bass (Stevens et al. 1985), Chinook salmon (Kjelson and Brandes 1989), and delta smelt (Bennett 2005). Entrainment occurs at Delta export facilities, agricultural diversions, and power plants, where fish species are trapped by the facility during operations and subsequently exposed to high levels of predation and direct mortality from impingement[1] (Reclamation 2008). The effects of diversions on individual species vary depending on the facility type, and while efforts are made to salvage entrained fish and transport them to another location in the Delta, losses of fish due to predation remain high despite these efforts (Bureau of Reclamation 2008, California Department of Water Resources 2009). These non-natural increases in mortality possibly inhibit the abundance, distribution, diversity, and growth of special-status species populations such as Chinook salmon, steelhead, delta smelt, longfin smelt, and splittail.

Both the SWP and the CVP operate fish salvage facilities to reduce the impacts associated with fish entrainment (for more detailed information on existing facilities and operations see BDCP Chapter 4 on Covered Activities). The SWP operates the John E. Skinner Fish Protective Facility and the CVP operates the Tracy Fish Collection Facility. Both salvage facilities have similar salvage processes where the fish are intercepted by louvers, collected, held in tanks, and trucked to various locations throughout the Delta. DWR and the Reclamation measure the efficiency of their salvage facilities by evaluating multiple factors including louver efficiency, prescreen predation, and transport efficiency. Both facilities currently operate at less than 100% salvage efficiency.

1A.2.9 Nonnative Species

The Delta is one of the most invaded ecosystems in the world, the result of accidental and purposeful introductions of nonnative species that have been occurring over many decades (State Water Resources Control Board 2008). Over the past several decades, the accidental introduction of many marine and estuarine organisms from the ballast water of ships has greatly changed the planktonic and benthic (bottom and shore dwelling) invertebrates of the Delta and directly affected the food web. Additionally, water management structures and activities have contributed to a reduction in the Delta's naturally diverse and variable ecosystem, resulting in more favorable conditions for successful colonization by invasive animal and plant species. Invasive aquatic and terrestrial species

[1] Impingement occurs when the force of a diversion causes a larger organism (in this case, fish) to be pinned against the fish screens. The force is such that it does not allow the fish the opportunity to free itself.

from around the world dominate the Delta today, particularly in fresh and low salinity habitats (CALFED 2008).

Nonnative species are known to have harmful effects on the Delta ecosystem and may directly and indirectly threaten native species by altering ecosystem functions and the food web and competing with or directly preying upon native species. Recent conservation interest has focused on the introduction of invasive clams and invasive aquatic plant species that may have a large impact on the ecology of the Delta (CALFED 2008; State Water Resources Control Board 2008). Nonnative invertebrate species currently found in the Delta, such as the Asian (*Corbula*) and overbite clams (*Corbicula*), as well as recent California invaders (not yet found in the Delta) such as quagga and zebra mussels, have high colonization and filtration rates that limit phytoplankton and zooplankton abundance. Nonnative aquatic weeds also pose serious problems in the Delta because of their ability to displace native plant species, harbor nonnative predatory species, reduce food web productivity, reduce turbidity, and interfere with water conveyance and flood management systems. For example, Brazilian waterweed is often referred to as an “ecosystem engineer” because it has affected the natural environment within the Delta by reducing suitable habitat for native species, reducing turbidity, and improving habitat conditions for invasive species (CALFED 2008).

More information regarding nonnative species in the aquatic environment can be found in EIR/EIS Chapter 11, *Fish and Aquatic Resources*. Descriptions of nonnative species that impact terrestrial communities in the Delta can be found in EIR/EIS Chapter 12, *Terrestrial Biological Resources*.

1A.3 History of Water Supply Facilities and Systems

As a water distribution system, the Delta of today not only serves the State and federal projects but also many agricultural and municipal water diverters surrounding and within the Delta itself. Delta water from the State Water Project serves both urban and agricultural areas in the Bay Area, the Silicon Valley, the San Joaquin Valley, the Central Coast, and Southern California. All of the major water development projects that export from the upstream watersheds or Delta (or develop water for in-Delta urban use) are listed below, along with their approximate year of initial water delivery.

List of Key In-Delta and Upstream Urban & Export Projects

Project	Watershed	Year Completed
Mokelumne River Aqueduct	East	1929
Hetch Hetchy Aqueduct	San Joaquin	1934
Contra Costa Canal	Delta	1940
Friant-Kern Canal	San Joaquin	1951
Delta Mendota Canal (Jones Pumping Plant)	Delta	1951
SWP (Banks Pumping Plant)	Delta	1968
North Bay Aqueduct	Delta	1988

This section provides a brief history of the development of the Delta as a water distribution system with a focus on the largest of the water supply systems, the SWP and CVP.

Water supply development in California began well before the state was admitted into the Union. Between 1772 and the mid-1800s, construction of the first water storage and diversion projects was initiated in support of the developing missions (Lauer 2008). These projects firmly established the practices of diversion, storage, and conveyance of water for irrigation purposes. Early irrigation projects provided little in the way of long-term storage or flood management. As a result, crops were often ruined by devastating floods and droughts. Water demands increased during the Gold Rush and local mining boom in the 1840s and 1850s (Apple 2004). The development of the transcontinental railroad further stimulated the demand for water. In response, throughout the latter part of the 19th and the beginning of the 20th Century, larger irrigation projects were constructed in the San Joaquin and Sacramento Valleys (Paggi 2001). Miles of canals were dug by local farmers and diversions were created. However, these rudimentary water distribution systems were still not capable of providing an ample, reliable water supply.

In the early part of the 20th century, California water leaders recognized that many areas lacked the engineered works and financial resources to meet their water needs. The concept of a statewide water development project was first proposed in 1919 by Col. Robert Marshall of the United States Geological Survey (USGS). Under Marshall's plan, a dam would be constructed on the San Joaquin River near Friant and water would be diverted to areas in the eastern San Joaquin Valley. In addition, water in the Sacramento Valley would be collected, stored, and transferred to the San Joaquin Valley by a series of reservoirs, pumps, and canals. The main storage facility would be the Shasta Dam. Hydroelectric power generated at Shasta Dam would provide the power to send water from the Delta to irrigated lands in the San Joaquin Valley.

Intrigued by Marshall's plan, the California Legislature authorized a series of investigations. In 1931, after extensive study, the State developed the first California State Water Plan. This plan was passed by the Legislature in 1933 as part of the California Central Valley Project Act. The Act authorized the sale of revenue bonds to finance the construction of the State Water Project. However, because of the Great Depression, the bonds didn't sell. To assist California, Congress passed the Federal Central Valley Project Act, which authorized the U.S. Bureau of Reclamation (Reclamation) to construct several of the facilities that were identified and described in the State's Central Valley Project Act. The primary purpose of these facilities was to satisfy agricultural water demands in the Sacramento and San Joaquin River Valleys. Specifically, the Act authorized the construction of the Shasta Dam on the upper Sacramento River, Friant Dam on the San Joaquin River, Contra Costa Pumping Plant and Canal in the Delta, the C. W. "Bill" Jones Pumping Plant (Jones Pumping Plant), and the Delta-Mendota Canal in the Delta and the San Joaquin Valley. The construction of other facilities called for in the State Water Plan, such as the Trinity River Division and Folsom Dam and Power Plant, was authorized in subsequent years.

Additional water imports into Southern California began in the 1950s to meet an increasing urban (municipal) demand. In response to the growing water demands in the southern San Joaquin Valley and southern California, the California Legislature passed the Burns-Porter Act in 1960 to fund the creation of the SWP. The SWP consists of a complex system of dams, reservoirs, power plants, pumping plants, canals, and aqueducts to deliver water. Although initial transportation facilities were essentially completed in 1973, other facilities have since been built, and still others are either under construction or are planned to be built as needed.

The period between 1940 and 1970 witnessed the most extensive development of water projects in California. During this period, most of the current features of the SWP and CVP were constructed, several other federal dams and reservoirs were built, and several locally owned and operated dams and reservoirs were constructed or expanded.

Following are key milestones in the history of the water supply system:

- 1931: The federal government and the State Water Resources Commission (Hoover-Young Commission) recommend that the federal government construct the CVP and that the state operate the facilities.
- 1933: The State of California passes the CVP Act and authorizes $170 million worth of bonds for the construction of the Shasta Dam and Power Plant, Friant Dam and Power Plant, Contra Costa Canal, Madera Canal, Friant Kern Canal, other dams and pumps on the San Joaquin River, transmission lines from Shasta to Antioch, and a pump station between the Sacramento and San Joaquin Rivers. However, because of the Great Depression, the bonds fail to sell.
- 1935: The federal government approves $20 million in Emergency Relief Appropriation Funds and the Rivers and Harbors Act authorizes the CVP.
- 1937: Congress reauthorizes the Rivers and Harbors Act, including the CVP, and states the purposes of the project.
- 1944: Congress adopts the Flood Control Act of 1944, including authorization for the Shasta, Folsom, and New Melones dams.
- 1954: Congress adopts the Grassland Development Act to add fish and wildlife interests as authorized purposes of the CVP and to authorize cooperation with the State to supply water to grasslands for waterfowl interests.
- 1955: Congress adopts the Trinity River Act to authorize the Trinity River Division to allow for preservation and propagation of fish and wildlife.
- 1957: The State Water Plan is completed, which presents preliminary plans for developing all of the State's water resources in order to meet its ultimate water needs. Those plans include a system of reservoirs, aqueducts, pumping and power plants that would transport water from areas of surplus in the north to the water-deficient south.
- 1959: The California Legislature adopts the State Water Plan and enacts the Burns-Porter Act, which provides for initial funding of $1.75 billion in general obligation bonds and authorizes construction of SWP facilities.
- 1960: Congress adopts the San Luis Authorization Act to authorize the San Luis Unit and provide for Reclamation participation in recreation facilities.
- 1960: The Burns-Porter Act is approved by California voters to finance the SWP.
- 1962: Congress modifies the 1944 New Melones Dam authorization to include irrigation, power, wildlife and fishery enhancement, recreation, and water quality.
- 1965: Congress adopts the Auburn-Folsom South Unit Authorization Act to authorize the Auburn-Folsom South Unit, including participation in the development of recreation facilities.
- 1986: Congress adopts Public Law 99-5546 to authorize the Secretary of the Interior to execute the Coordinated Operations Agreement (COA) for the SWP and CVP.
- 1992: Congress adopts Public Law 102-575, with 40 separate titles including Title 34, which is the Central Valley Project Improvement Act (CVPIA). The CVPIA amends the authorized purposes and requires changes to the management of the CVP, particularly for the protection, restoration, and enhancement of fish and wildlife.

1A.3.1 Central Valley Project

The CVP was originally conceived as a State project to protect the Central Valley from water shortages and floods by regulating and storing water in reservoirs in the water-rich northern half of the State and transporting it to the water-poor San Joaquin Valley and its surrounding areas by means of a series of canals, aqueducts and pumping plants. While the Central Valley is an ideal place for agriculture because of its rich soils and favorable weather, early farmers in central California often found themselves troubled by frequent floods in the Sacramento Valley and a general lack of water in the San Joaquin Valley. Following the passage of the CVPIA in 1992, the CVP now includes the protection, restoration, and enhancement of fish and wildlife as equal project purposes.

The basic concept and facilities of the CVP were included in the first California State Water Plan formulated in the 1930s. In the Depression era, however, the State was unable to sell the necessary bonds to finance the project. Most of the water development envisioned by the State was eventually accomplished by the federal CVP, beginning with its initial authorization in 1935. Construction on the CVP began in 1937 with the Contra Costa Canal, which began delivering water in 1940. The next facility built was Shasta Dam, the keystone of the CVP. Work on the dam began in 1938, and water storage started even before its completion in 1945. Congress subsequently passed 13 separate measures to authorize the construction of other major water management and storage facilities over the next three decades, including Friant Dam, which was completed in 1942. The final dam, New Melones, was completed in 1979. See Figure 1A-4 for an illustration of the major components of the CVP. Today, some features of the project remain unconstructed, some are still only partly finished, and others are still awaiting authorization.

The CVP remains one of Reclamation's most ambitious projects and has grown over nearly 80 years to become one of the largest water storage and transport systems in the world. In years of normal precipitation, it stores and distributes about 20 percent of the state's developed water—about 7 million acre-feet[2] (af)—through its massive system of reservoirs and canals. Water is transported 450 miles from Lake Shasta in northern California to Bakersfield in the southern San Joaquin Valley.

There are eight divisions of the CVP and ten corresponding units, many of which operate in conjunction, while others are independent of the rest of the network. The eight divisions are Shasta, Sacramento River, Trinity River, American River, Friant, Delta, West San Joaquin, and San Felipe.

The Shasta Division consists of a pair of large dams (Shasta and Keswick) located on the Sacramento River north of the City of Redding. The Shasta Dam is the primary water storage and power-generating facility of the CVP. It impounds the Sacramento River to form Shasta Lake, which can store over 4,500,000 af of water. Shasta Dam functions to regulate the flow of the Sacramento River so that downstream diversion dams and canals can capture the flow of the river more efficiently, and to prevent flooding in the Sacramento–San Joaquin Delta where many water pump facilities for San Joaquin Valley aqueducts are located. The Keswick Dam functions as an afterbay (regulating reservoir) for the Shasta Dam, and like Shasta, generates power. Releases from Shasta and Keswick dams help control salinity in the Delta Division, as well as provide cold water flows for migrating salmon.

[2] An acre-foot is the amount of water that would cover a 1-acre area to a depth of 1 foot. One acre-foot equals 325,851.429 U.S. gallons.

The Sacramento River Division includes diversion dams, pumping plants, and canals that provide municipal water supplies and irrigation. The Red Bluff Diversion Dam, on the Sacramento River about 2 miles southeast of Red Bluff, diverts water from the Sacramento River to the Corning and Tehama–Colusa Canals. To meet migration needs, newly installed pumps are used to divert water from the Sacramento River to the Tehama–Colusa and Corning canals during periods when the dam gates are opened. The Sacramento River supplies water to Tehama, Glenn, Colusa, and Yolo counties for irrigation.

The Trinity River Division's primary purpose is to divert surplus water from runoff and melting snow from the Trinity River, in the Klamath River Basin, via the Lewiston Dam and Clear Creek Tunnel, into the Sacramento River drainage downstream of Shasta Dam, in order to provide more flow in the Sacramento River and generate peaking power in the process. Water from the Trinity River Division enters the Sacramento River at Keswick Reservoir in the Shasta Division. Trinity Dam forms Trinity Lake, which is the second largest CVP water-storage reservoir, with just over half the capacity of Shasta. Lewiston Dam lies just downstream of Trinity Dam and diverts water into the Clear Creek Tunnel, which brings it into a third reservoir, Whiskeytown Lake on Clear Creek, a tributary of the Sacramento River.

The American River Division is located in north-central California, on the east side of the Great Central Valley. It manages the water of the American River, which drains off the Sierra Nevada and flows into the Sacramento River. The American River Division stores water in the American River watershed to both provide water supply for local settlements and supply it to the rest of the system. The division is divided into three units: Folsom, Sly Park, and Auburn-Folsom South. Two structures impound the water of the American River - Folsom Dam and Nimbus Dam. The Folsom Unit consists of Folsom Dam, its primary water storage component, and Nimbus Dam, which serves as its downstream forebay. These two dams provide flood management on the American and Sacramento rivers.

South of Sacramento lies the Delta. The Delta is crucial to the State's overall water supply, as it is in the heart of both the SWP and CVP water systems. Water from the Delta is sent southward via a series of aqueducts and pumping plants to supply water to farms and cities. The Delta Cross Channel intercepts Sacramento River water as it travels westward toward Suisun Bay, and diverts it south through a series of man-made channels, the Mokelumne River, and other natural sloughs, marshes and distributaries. From there, the water travels to the Jones Pumping Plant, which raises water into the Delta-Mendota Canal, which in turn travels 117 miles southward to Mendota Pool on the San Joaquin River, supplying water along the way to other CVP reservoirs. The Tracy Fish Collection Facility sits at the entrance of the Jones pumping plant to catch fish that would otherwise end up in the Delta-Mendota Canal. A second canal, the Contra Costa Canal, captures fresh water near the central part of the Delta, taking it 48 miles southward, distributing water to the Clayton and Ygnacio Canals in the process, and supplying water to Contra Loma Dam, eventually terminating at Martinez Reservoir.

The Friant Dam is the largest component of the Friant Division of the CVP. The dam crosses the San Joaquin River where it spills out of the Sierra Nevada, forming Millerton Lake, which provides water storage for San Joaquin Valley irrigators. The entire flow of the San Joaquin River, except for flood management and irrigation releases, is held at Millerton Lake and delivered south for irrigation purposes through the Friant-Kern Canal to Tulare, Fresno and Kern counties, and north through the Madera Canal to the Chowchilla River. The San Joaquin River Restoration Program influences the San Joaquin River's flow from Friant Dam to the confluence of Merced River. The program has two goals – to restore a self-sustaining Chinook salmon fishery in the river, and to reduce or avoid adverse water supply impacts from restoration flows. Interim Flow water releases began from Friant Dam into the San Joaquin River on October 1, 2009 and Full Restoration Flows are scheduled to start no later than January 1, 2014.

Along the Stanislaus River, a major tributary of the San Joaquin River, is the New Melones Dam and Powerplant. The dam primarily operates as a flood management and power facility, but Reclamation has contracts to supply water to several water districts in the northern San Joaquin Valley area.

The CVP also has a number of facilities for storing and transporting water on the west side of the San Joaquin Valley. The West San Joaquin Division and San Luis Unit consist of several major facilities that are shared with the State Water Project. The San Luis Unit provides storage for the CVP for dry seasons. The San Luis Unit facilities are jointly operated by Reclamation and California's Department of Water Resources (DWR). The William R. Gianelli Pumping-Generating Plant, one of the joint facilities, pumps surplus water from the Delta-Mendota Canal and the California Aqueduct into San Luis Reservoir, the largest off-stream storage reservoir in the United States. When water flow through the Delta becomes too low, water is released from the San Luis Unit into the Delta-Mendota Canal and the California Aqueduct.

The San Felipe Division has facilities that divert water from the San Luis Reservoir into lands west of the Coastal Mountain Range, south of the San Francisco Bay.

Approximately 250 contracts provide for varying amounts of CVP water to be distributed across 29 counties. Most of these contracts were initially for a term of 40 years although many have been renewed consistent with the requirements of CVPIA. The nature of the contracts varies, as some were entered into with entities that claim water rights senior to those of the CVP, while other contracts are for water service. Some of the contracts, including the Sacramento River Settlement Contracts, the San Joaquin Exchange Contracts, and certain state and federal wildlife refuge contracts, have defined minimum diversions or deliveries.

1A.3.2 State Water Project

Even before the construction of major features of the CVP had been completed, interest was expressed that California build its own water project, one that would deliver irrigation water to Southern California and to San Joaquin Valley farms that were ineligible for CVP water.

In 1951, A. D. Edmonston, the state engineer, unveiled a blueprint for what became the Feather River Project (today, the SWP). The Legislature approved the project, but no funding was provided to build it. Despite the lack of funding, interest in the project continued to build, gaining critical momentum in 1955 when a Christmas Eve flood of the rain-swollen Feather River claimed 64 lives north of Sacramento and caused $200 million in property damage.

The SWP and its funding was finally authorized by the California Legislature in 1959 and approved by the voters in 1960 through the Burns-Porter Act. The Burns-Porter Act expressly authorized the State of California to enter into contracts for the sale, delivery, or use of water made available by the State Water Resources Development System [California Water Code 12937(b)(4)]. The initial water resource facilities that were authorized under the Act included the Oroville Dam and Reservoir, Harvey O. Banks Pumping Plant (Banks Pumping Plant), California Aqueduct, San Luis Dam and Reservoir, and additional downstream conveyances, pumping facilities, and storage reservoirs. Water was first delivered in 1962 through a portion of the South Bay Aqueduct to Alameda and

Santa Clara counties. Large-scale water deliveries began in the late 1960s. By 1972, SWP water reached Southern California.

The SWP was planned, designed, constructed and is now operated and maintained by DWR. Today, the SWP is the world's largest publicly built and operated water and power development and conveyance system, consisting of 34 storage facilities, reservoirs and lakes; 20 pumping plants; 4 pumping-generating plants; 5 hydroelectric power plants; and about 701 miles of open canals and pipelines. Figure 1A-4 shows the names and locations of primary water delivery facilities. Water from rainfall and snowmelt runoff is stored in SWP facilities and delivered via SWP transportation facilities to water agencies and districts in the Southern California, Central Coastal, San Joaquin Valley, South Bay, North Bay, and Upper Feather River areas. The Project provides water for 25 million of California's estimated 37 million residents and irrigates about 750,000 acres of farmland. However, the SWP is also operated to improve water quality in the Delta, control Feather River flood water, generate power, provide recreation, and enhance fish and wildlife.

Oroville Dam is the centerpiece of the SWP and its largest water storage facility. The Oroville Dam is located about 70 miles north of Sacramento at the confluence of the three forks of the Feather River. Lake Oroville releases water into the Feather River, which travels down the river to the confluence with the Sacramento River, the state's largest waterway. Water flows down the Sacramento River into the Delta. Some of the SWP's water supply is diverted into the North Bay Aqueduct via Barker Slough Pumping Plant and is used in Napa and Solano counties.

Near Byron, the SWP diverts water into Clifton Court Forebay for delivery south of the Delta. Banks Pumping Plant lifts water from Clifton Court Forebay into the 444-mile-long California Aqueduct. Water then enters Bethany Reservoir, where the South Bay Aqueduct begins. The South Bay Aqueduct serves Alameda and Santa Clara counties.

Most of the water delivered to Bethany Reservoir from Banks Pumping Plant, however, flows into the California Aqueduct. This main artery of the SWP conveys water to the agricultural lands of the San Joaquin Valley and to the urban regions of Southern California. Water in the mainstem of the California Aqueduct flows south by gravity into the San Luis Joint-Use Complex, which was designed and constructed by the federal government and is operated and maintained by DWR. Within the complex are the O'Neill Forebay, the Sisk Dam, the San Luis Reservoir, the Gianelli Pumping-Generating Plant, Dos Amigos Pumping Plant, and the San Luis Canal. Generally, water is pumped into the San Luis Reservoir from late fall through early spring, where it is temporarily stored for release later in the year to meet summertime peaking demands of SWP and CVP water contractors.

SWP water not stored in the San Luis Reservoir, as well as water eventually released from the San Luis Reservoir, flows south through the San Luis Canal, a section of the California Aqueduct which serves both the SWP and CVP. After leaving the San Luis Joint-Use Complex, water travels through the central San Joaquin Valley and splits off near Kettleman City into the Coastal Branch Aqueduct, completed in 1997, to serve San Luis Obispo and Santa Barbara counties.

The remaining water in the mainstem of the California Aqueduct is pumped up California's hilly terrain, lifted more than 1,000 feet by four pumping plants—Dos Amigos, Buena Vista, Teerink, and Chrisman—until it reaches the SWP's largest pumping plant, the Edmonston Pumping Plant. Its fourteen motor-pump units, each standing about 65 feet tall and weighing more than 400 tons, lift water nearly 2,000 feet up and over the Tehachapi Mountains through 8.5 miles of tunnels and siphons. As the water reaches the bottom of the Tehachapi Mountains, it bifurcates into two branches: the West Branch and the East Branch (mainstem).

Water in the West Branch is pumped by the Oso Pumping Plant into Quail Lake. From there, water enters a pipeline leading into the Warne Powerplant to generate power. Water is then discharged into Pyramid Lake, travels through Angeles Tunnel, and into the Castaic Powerplant (the latter two are joint developments by DWR and the Los Angeles Department of Water and Power, the owner of the facilities). At the end of the West Branch is Castaic Lake, the terminal reservoir, and Castaic Lagoon, a popular southern California recreation spot.

Water flowing down the East Branch generates power at the Alamo Powerplant then is pumped uphill by the Pearblossom Pumping Plant, which lifts water 540 feet into the San Bernardino Mountains. From there, water flows downhill through an open aqueduct, linked at its end to four underground pipelines that carry the water into the Mojave Siphon Powerplant, which discharges water into Silverwood Lake. When water is needed, it is discharged through the San Bernardino Tunnel into Devil Canyon Powerplant and its two afterbays. The 28-mile-long Santa Ana Pipeline then takes the water underground to Lake Perris, the southernmost SWP facility and one of Southern California's most popular recreation spots. The East Branch extension is nearly 33 miles of pipeline, linking parts of the service areas of the San Bernardino Valley Municipal Water District and the San Gorgonio Pass Water Agency to the California Aqueduct. The East Branch Extension, Phase 1, carries water from Devil Canyon Powerplant Afterbay to Cherry Valley, bringing water to Yucaipa, Calimesa, Beaumont, Banning, and other communities. Phase 2, when completed, will assist with this delivery.

The SWP was originally designed to include substantial upstream storage to reduce the frequency and magnitude of variations in supply and provide more reliable and consistent deliveries to urban and agricultural water users on a year-to-year basis. Many upstream storage projects have been extensively studied and planned but never built, such as those at Los Banos Grandes and Sites, as well as the enlargement of the Shasta Reservoir.

In the 1960s, DWR entered into long-term water supply contracts with 32 water districts and agencies to provide water from the SWP. Over the years, a few of these water agencies have been restructured. Today, there are 29 agencies and districts that have long-term contracts with DWR for the delivery of SWP water. These agencies, in turn, deliver water to wholesalers or retailers or deliver it directly to agricultural and M&I water users.

The amount of each contract for SWP water is specified in "Table A." Table A amounts are used to define each contractor's proportion of the available water supply that DWR will allocate and deliver to that contractor. Each year, contractors may request an amount not to exceed their Table A amount. The Table A amounts are used as a basis for allocations to contractors, as the actual supply to contractors is variable and depends on the amount of water available. The contracts are in effect for the following periods, whichever is longest based on the contract: the project repayment period that extends to the year 2035, 75 years from the date of the contract, or the period ending with the latest maturity date of any bond issued to finance project construction costs.

1A.4 Operational Framework of the Delta

Over the last several decades, laws and regulations to protect, conserve, and restore environmental resources have been enacted, shaping the way that DWR and Reclamation manage and operate the SWP and CVP facilities. Reservoir releases and Delta exports must be coordinated to ensure that both projects operate within agreed-upon procedures and in a manner consistent with the terms and conditions imposed in their water rights permits and licenses. State Water Resources Control Board (SWRCB) decisions and orders, court decisions, and the state and federal biological opinions and related court decision for endangered species largely determine Delta regulatory requirements for water quality, flow, and operations. The SWRCB Water Quality Control Plan (WQCP) and applicable water rights decisions, as well as other agreements, must be considered in determining the operations of both the SWP and CVP. The Federal Endangered Species Act has greatly influenced CVP and SWP operations, especially in the last decade. Major state and federal regulatory actions that have historically influenced operations of the SWP and/or the CVP are summarized in Table 1A-1.

Appendix Table 1A-1. Major Federal and State Regulatory Actions Affecting SWP and/or CVP Operations

Action	Year	Description
Flood Control Act of 1944	1944	Congress adopted Flood Control Act of 1944 including authorization for Shasta, Folsom, and New Melones dams.
CVP Water Contracts	1944	Shasta Dam completed on the Sacramento River, initial CVP water contracts signed, and water diversions began.
CVP Water Contracts	1950	CVP signs water rights contracts with riparian and senior appropriative water rights holders on Sacramento and American rivers.
Grassland Development Act	1954	Congress adopted the Grassland Development Act to add fish and wildlife purposes as authorized purposes of the CVP and to authorize cooperation with the state to supply water to Grasslands for waterfowl conservation.
Reclamation Project Act	1956	Congress reauthorized the Reclamation Project Act including provision for right of renewal for long-term CVP agricultural user contracts for terms not to exceed 40 years.
California Water Plan	1957	The California Water Plan was completed. It described a comprehensive master plan for the control, protection, conservation, distribution, and utilization of the waters of California.
Fish and Wildlife Coordination Act	1958	Congress adopted the Fish and Wildlife Coordination Act to integrate U.S. Fish and Wildlife Service (USFWS) conservation programs with federal water resources facilities, to authorize facilities to mitigate CVP-induced damages to fish and wildlife resources, and to require consultation for CVP facilities with USFWS.
Interagency Delta Committee	1961	DWR established the Interagency Delta Committee to evaluate solutions for Delta problems. A Report from the committee recommended various Delta facilities, including the Peripheral Canal.
Water Quality Control Plan	1967	SWRCB adopted the WQCP for the Delta pursuant to Federal Water Pollution Control Act of 1965.
National Environmental Policy Act	1969	Congress adopted the National Environmental Policy Act (NEPA), which establishes national environmental policy and goals for the protection, maintenance, and enhancement of the environment, and provides a process for implementing these goals within federal agencies.
California Environmental Quality Act	1970	California Environmental Quality Act enacted, instituting a statewide policy of environmental protection requiring state and local agencies within California to follow a protocol of analysis and public disclosure of potential environmental impacts prior to project approval.
SWRCB WR Decision D-1379	1971	SWRCB adopted Water Rights Decision-1379 establishing Delta water quality standards.

Action	Year	Description
Endangered Species Act	1973	Congress adopted the Endangered Species Act, the purposes of which are to provide a means of conserving the ecosystems upon which endangered and threatened species depend, and to provide a program for conserving those species.
SWRCB WR Decision-1485	1978	SWRCB adopted Decision-1485 to guarantee water quality protections for agricultural, municipal, and fish and wildlife uses.
USACE Public Notice 5820A, issued pursuant to Section 10 of the Rivers and Harbors Act	1981	Modified previous permits for the operation of the Banks Pumping Plant and Clifton Court Forebay. Limits diversions into Clifton Court Forebay; maximum diversion rates into CCF are 13,870 af daily (and 13,250 af over a 3-day average).
California Endangered Species Act (Cal Fish & Game Code 2050 et seq.)	1984	The California Endangered Species Act established the policy of the State to conserve, protect, restore, and enhance threatened or endangered species and their habitats. CESA mandates that state agencies should not approve projects that would jeopardize the continued existence of threatened or endangered species if reasonable and prudent alternatives are available that would avoid jeopardy.
Coordinated Operations Agreement	1986	Coordinated agreement regarding the operations of SWP and CVP by DWR and Reclamation. Determined the respective water supplies of the CVP and the SWP while allowing for a negotiated sharing of Sacramento–San Joaquin Delta excess outflows and the satisfaction of in-basin obligations between the two projects.
Sacramento River Winter-run Chinook Salmon listing	1989	Sacramento River winter-run Chinook salmon listed as endangered species by the State of California and as threatened by the federal government.
SWRCB Orders WR 90-05 and WR 91-01	1990, 1991	Water right orders, by the SWRCB, that modified Reclamation water rights to incorporate temperature control objectives in the upper Sacramento River.
Central Valley Project Improvement Act	1992	CVPIA mandated changes in the purposes and management of the CVP, particularly for the protection, restoration, and enhancement of fish and wildlife.
National Marine Fisheries Service (NMFS) Biological Opinion for Winter-run Chinook Salmon	1992, 1993, 1995	NMFS Fisheries Biological Opinion issued for winter-run Chinook salmon. RPA required specific Sacramento River operations to protect winter-run.
USFWS Biological Opinion for Delta Smelt and Sacramento Splittail	1993, 1994, 1995	USFWS Biological Opinion for delta smelt and Sacramento splittail issued. Operational criteria to protect delta smelt established.
SWRCB WR Decision-1631	1994	The SWRCB modified the Los Angeles Department of Water and Power water rights to divert water from tributaries to Mono Lake.
Bay Delta Plan Accord and SWRCB Order WR 95-06	1994, 1995	The Bay Delta Plan Accord, an agreement and associated SWRCB order, provided for the operations of the SWP and CVP to protect Bay-Delta water quality. It also provided for further evaluation of Bay-Delta operations, pursued under the newly established CALFED Program.
Water Quality Control Plan for the San Francisco Bay/ Sacramento–San Joaquin Delta estuary and SWRCB Revised WR Decision-1641	1995, 2000, 2006	The WQCP revision established revised water quality objectives for flow and salinity in the Delta and superseded previous plans. The SWRCB adopted a water rights order (later revised) to provide for the operations of the SWP and CVP to protect Bay-Delta water quality. The 2006 revisions did not include substantive changes to water quality standards from the 1995 WQCP.

Action	Year	Description
Monterey Agreement and Amendments, Settlement Agreement, and Monterey Plus EIR	1995, 2003, 2010	Monterey Agreement between DWR and SWP contractors to revise water supply allocation and management under the SWP water supply contracts.
NMFS Biological Opinions	1996, 1997	NMFS Biological Opinions issued. Established criteria to protect Coho salmon and steelhead in coastal streams.
CALFED Bay-Delta Program EIS/EIR and Record of Decision (ROD)	1999, 2000	Beginning of the CALFED Bay-Delta Program EIS/EIR and ROD, involving Reclamation, DWR and other state and federal agencies committed to implementing a long-term plan to restore the Bay-Delta, guided by four major resource management objectives—water supply reliability, ecosystem restoration, water quality, and levee system integrity.
Trinity ROD and Related Decisions	2001, 2004	Trinity ROD and related decisions restored flows on the Trinity River. The ROD was upheld by the federal court in 2004.
NMFS Biological Opinion for Salmonids	2004	NMFS Biological Opinion for Salmonids issued stating a finding of no jeopardy on the effects of the continued long-term SWP and CVP operations.
USFWS Biological Opinion for Delta Smelt	2004, 2005	USFWS Biological Opinion for delta smelt issued stating a finding of no jeopardy on the effects of the continued long-term SWP and CVP operations.
USFWS Biological Opinion	2008	USFWS issued Biological Opinion concluding that the effects of the proposed long-term operation of the SWP and CVP are likely to jeopardize the continued existence of delta smelt. Under Section 7 of the ESA (50 CFR 402.02), USFWS developed a five-part RPA to avoid jeopardy to delta smelt and adverse modification of its critical habitat.
NMFS Biological Opinion	2009	NMFS Biological Opinion issued concluding that the effects of the proposed operations are likely to jeopardize the continued existence of the following species: 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. NMFS further concluded that the SWP and CVP operations are not likely to jeopardize the continued existence of Central California coast steelhead. NMFS developed an RPA composed of numerous elements for each of the various project divisions and associated stressors and determined that the RPA must be implemented in its entirety in order to avoid jeopardy and adverse modification of critical habitat.

Source: CDFW Tracking Number 2080-2011-022-00; CDFW Tracking Number 2080-2009-011-00; DWR and Bureau of Reclamation 2005 (modified from SDIP Draft EIS/EIR); Bureau of Reclamation 1997.

1A.5 Coordinated Operations Agreement

Because the CVP and SWP use the Sacramento River and the Delta to convey their water supply, reservoir releases and Delta exports must be coordinated to ensure that each project achieves its share of benefit from shared water supplies and bears its share of joint obligations in order to protect beneficial uses.

The agreement between the United States and the State of California for the coordinated operation of the CVP and the SWP was authorized by Public Law 99-546 in 1986, which superseded a 1960 agreement and annual coordination agreements that had been implemented since the SWP came on-line. Coordinated operations, by agreed-on criteria, was anticipated to increase the efficiency of both the SWP and CVP.

Under the COA, DWR and Reclamation agree to operate the SWP and CVP under balanced conditions in a manner that meets Sacramento Valley and Delta needs, while maintaining their respective annual water supplies as identified in the COA. Balanced conditions are defined as periods when the SWP and CVP agree that releases from upstream reservoirs, plus unregulated flow, approximately equal water supply needed to meet Sacramento Valley in-basin uses and SWP and CVP exports. Coordination between the CVP and SWP is facilitated by the implementation of an accounting procedure based on the sharing principles outlined in the COA.[3]

In summary, the COA defines the project facilities and their water supplies, sets forth procedures for coordination of operations, identifies formulas for sharing joint responsibility in order to meet Delta standards and other legal uses of water, identifies how unstored flow will be shared, sets up a framework for the exchange of water and services between the SWP and CVP, and provides for a periodic review every 5 years.

1A.5.1 Considerations in Coordinated Operations

1A.5.1.1 Sacramento River Temperature Control Operations

In 1990 and 1991, the SWRCB issued Water Rights Order 90-05 and 91-01, modifying Reclamation's water rights on the Sacramento River. The orders stated that Reclamation would operate Keswick and Shasta Dams and the Spring Creek Powerplant to meet a daily average water temperature of 56° Fahrenheit (F) as far downstream in the Sacramento River as practicable during periods when higher temperatures would be harmful to fisheries.

1A.5.1.2 CVPIA 3406(b)(2)

On May 9, 2003, the Interior issued its Decision on Implementation of Section 3406 (b)(2) of the CVPIA. Dedication of "(b)(2) water" occurs when Reclamation takes a fish, wildlife habitat restoration action based on recommendations of the FWS (and in consultation with NMFS and CDFW—at the time called the California Department of Fish and Game), pursuant to Section 3406 (b)(2). Such water is used for the primary purpose of implementing the fish, wildlife and habitat restoration purposes and measures authorized by Title XXXIV of Public Law 102-575. Dedication and management of (b)(2) water may also assist in meeting WQCP fishery objectives and helps meet the needs of fish listed under the ESA as threatened or endangered since the enactment of the CVPIA in 1992.

[3] During balanced conditions in the Delta when water must be withdrawn from storage to meet Sacramento Valley and Delta requirements, 75 percent of the responsibility to withdraw from storage is borne by the CVP and 25 percent by the SWP. The COA also provides that during balanced conditions when unstored water is available for export, 55 percent of the sum of stored water and the unstored export water is allocated to the CVP, and 45 percent is allocated to the SWP.

The May 9, 2003, Decision describes the means by which the amount of dedicated (b)(2) water is determined. Planning and accounting for (b)(2) actions are done cooperatively. Actions usually take one of two forms — in-stream flow augmentation below CVP reservoirs or CVP Jones Pumping Plant reductions in the Delta. The (b)(2) water is used for increased in-stream flows greater than those that would have occurred pre-CVPIA on Clear Creek through releases from Whiskeytown Dam; Upper Sacramento River below Keswick Dam; American River below Nimbus Dam; and Stanislaus River below Goodwin Dam. The (b)(2) water also is used to account for export curtailments at the CVP Jones Pumping Plant and increased CVP reservoir releases required to meet X2 outflow requirements per SWRCB D-1641, as well as direct export reductions for fishery management using dedicated (b)(2) water at the CVP Jones Pumping Plant.

1A.5.1.3 Refuge Water Supplies

Many refuges historically received water supplies from multiple sources such as irrigation return flows and temporary annual water contracts pre-CVPIA. However, water conservation programs, concerns about water quality from return flows, and increased demand for water reduced the reliability of these sources. The CVPIA provided a firm water supply (Level 2) for Central Valley wildlife refuges from existing CVP yield at the levels approximately equal to average refuge water supplies that occurred between 1977 and 1984, or equivalent amounts for refuges included in this program since 1984. The CVPIA also provided the ability to acquire an additional increment of water (Level 4) to meet total water demands on the refuges. Currently, the Level 2 water demands are about 422,000 acre-feet/year and Reclamation has been able to acquire water for delivery of about 133,000 acre-feet/year for Level 4 water supplies. The 19 refuges include National Wildlife Refuges and state-owned Wildlife Management Area. Approximately 35 percent of the Level 2 water is delivered to refuges in the Sacramento Valley, and 65 percent of Level 2 water and most of the Level 4 water are delivered to refuges in the San Joaquin Valley.

1A.6 Delta Regulatory Limits

Limits placed on the SWP Banks and the CVP Jones pumping operations under various hydrologic conditions and regulatory mandates sometimes restrict the Delta exports to less than the full CVP and SWP demands for Delta exports. These regulatory limits result from Delta outflow requirements, Delta salinity objectives, export/inflow limits, and permitted or physical export pumping capacity established by various regulatory agencies.

1A.6.1 1995 Water Quality Control Plan and SWRCB Water Right Decision 1641 (D-1641)

The State Water Board's *1995 Water Quality Control Plan* (WQCP) *for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary* (Bay-Delta Plan [1995]) and the State Water Board's *Final EIR for the Implementation of the 1995 Bay/Delta Water Quality Control Plan* (November 1999) incorporated several elements of the EPA, NMFS, and USFWS' regulatory objectives for salinity and endangered species protection. The plan provided various objectives relating to the operation of the Delta Cross Channel gates, outflow, exports, dissolved oxygen, and salinity. It also stated varying flow objectives for rivers, including the San Joaquin River at Vernalis. Pulse flows were to be provided to facilitate migration of salmon in the San Joaquin system. Depending on the water year type, average flows, from approximately April 15 to May 15, were set to somewhere between 3,110 and 8,620 cubic feet per second (cfs). Export limits during that same time period were set at the larger of 1,500 cfs or a 3-day running average of conditions at Vernalis. The 1995 WQCP has since been updated, but does not include any substantive changes to water quality standards from the 1995 WQCP.

The State Water Board fully implemented the 1995 WQCP with Water Right Decision 1641 (D-1641) in March 2000. D-1641 implements certain water quality objectives for the Sacramento–San Joaquin Bay-Delta Estuary on a long-term basis. In order to achieve these objectives, D-1641 ultimately amended certain water rights of the SWP and CVP.

The changes in regulatory limits for CVP and SWP Delta operations as a result of D-1641 were substantial and included new provisions for the position of X2, export / inflow ratio, and the Vernalis Adaptive Management Plan (VAMP). For example, meeting the X2 objectives can require additional water for outflow.

1A.6.1.1 Habitat Protection Outflow and Salinity Starting Conditions (X2 Standards)

A major regulatory cornerstone of the 1995 WQCP is the development of water quality standards based on the geographical position of the 2-parts-per-thousand (ppt) isohale (aka X2, the salinity gradient). The geographical position of the 2-ppt isohale is considered significant to the biologically important entrapment zone of the estuary and the resident fishery. D-1641 standards create a systematic approach for SWP/CVP operations to influence the position of the X2 location. The key to the regulatory system is the concept of an "X2 day." An X2 day can be operationally accomplished by the SWP/CVP meeting one of three potential equivalents:

- 2.64 mmhos/cm[4] electrical conductivity (EC) at the desired geographic compliance location for the day.
- 14-day average of 2.64 mmhos/cm EC at the desired geographic compliance location.
- A pre-determined Delta outflow equivalent for the desired X2 compliance location for the day.

If any of these conditions are met, the day is included as a potential compliance X2 day. The determination of the desired geographic compliance location and the required number of X2 days per month in the February to June time period is defined by regulatory standard tables. The tables determine the required number of X2 days based on the previous month's "8RI," which is the estimated full natural runoff of the largest eight streams in the Sacramento–San Joaquin watershed. Excess compliance days, at the desired geographic compliance location from the previous month, are allowed to be counted toward meeting the current month's regulatory required days.

D-1641 X2 requirements also contain a condition known as the "salinity starting gate" requirement. In all but very dry January conditions, the SWP/CVP project must ensure that the actual X2 water quality (on a daily or 14-day mean) is west of Collinsville for a least one X2 day during the February 1–14 time period. The salinity starting gate requirement is conditional for some dry January conditions and is based on the CALFED Ops Group discretion. The fishery significance of the salinity

[4] Mmhos/cm is a measure of electrical conductivity. Water containing dissolved salts is a better conductor than pure water.

starting gate is considered to place X2 generally west of SWP/CVP export influence and into the Suisun Marsh habitat environment.

1A.6.1.2 Export/Inflow Ratio Export Restrictions

Another significant regulatory cornerstone of the D-1641 standards is an export rate restriction standard known as the export/inflow (E/I) ratio. The E/I ratio is measured as the current average 3-day export rate for the SWP Clifton Court intake and CVP Tracy Pumping Plant divided by the estimated average inflow to the Delta over a 3- or 14-day period. The inflow parameter is required to be on a 14-day basis when hydrologic conditions are such that SWP/CVP exports are not supported by SWP/CVP reservoir storage withdrawals. This generally occurs during the winter and spring. The 3-day inflow parameter basis occurs when SWP/CVP exports are supported by SWP/CVP reservoir storage withdrawals, and generally occurs in the late spring through the first significant rains in the fall or winter. D-1641 standards for the E/I ratio generally require a ratio of 35 percent during February to June and 65 percent in all other months. The E/I standard is relaxed to 45 percent in February after the driest of January runoff conditions (8 River Index < 1.0), or may be relaxed to 45 percent after a January for which the 8 River Index is in the range 1.0 to 1.5, after consultation. The biological rationale of the E/I ratio requirement is to require the SWP/CVP export operations to avoid exporting the leading edge of increased inflows produced by rain events into the Delta environment. Prior to D-1641 E/I ratio standards, the SWP/CVP export operations often increased exports prior to the beginning of increased Delta inflow based on anticipated inflow quantity and duration to the Delta and estimated incremental effects to the Delta water quality environment.

1A.6.1.3 Minimum Delta Outflow

D-1641 instituted a set of minimum monthly Delta outflow requirements. The requirements are designed for the months outside of the February to June X2 period and are segregated by hydrologic year type. D-1641 standards are designed to be complementary to the X2 habitat standard by “regulating” the eastward movement of X2 during the summer timeframe based on hydrologic conditions. Wetter conditions have higher outflow requirements in the July–August timeframe. The standard also sets a minimum outflow requirement for fall/early winter, with minor relaxation for critical years or a dry December. The minimum monthly outflow standards also contain sub-month running average requirements designed to moderate or elevate protection levels when the monthly hydrologic conditions are dominated by a single Delta inflow event.

The regulatory combination of X2 standards, E/I ratio export restrictions, or minimum Delta outflow requirements creates a dynamic hydrologic environment for SWP/CVP operations controlling Delta requirements. When rain events change the anticipated hydrologic conditions to the Delta environment, the controlling Delta requirement can easily and quickly change from a minimum Delta outflow requirement or X2 habitat requirement to an E/I ratio limitation and subsequently back to a sub-month running average minimum Delta outflow requirement. Therefore, the value of projecting SWP/CVP export operations is limited to short time periods. Projecting SWP/CVP export operations over a season or annual basis is sensitive to the magnitude, duration, and season that significant Delta inflow events occur.

1A.6.2 Federal Endangered Species Act

Section 7(a)(2) of the Endangered Species Act (16 U.S.C. § 1536(a)(2)) (ESA) *prohibits* a federal agency action that is likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or modification of its critical habitat. If an agency's proposed action is likely to adversely affect a threatened or endangered species or its critical habitat, it must engage in a formal consultation with either NMFS or USFWS (fish and wildlife services) and obtain a written biological opinion as to the impacts of the proposed action on the listed species. NMFS is consulted for impacts to protected marine species (including anadromous fish), and USFWS is consulted for impacts to protected non-marine and non-anadromous fish and wildlife species. The consultation process may conclude with the fish and wildlife service issuing a non-jeopardy (not likely to jeopardize determination) biological opinion along with an incidental take statement, allowing the action to proceed without prosecution for incidental take of listed species. If the fish and wildlife service finds the action is likely to jeopardize a listed species or adversely modify its critical habitat, a jeopardy biological opinion is issued, which will include a reasonable and prudent alternative (RPA) to the planned action to avoid jeopardy or adverse modification of critical habitat.

In the Delta, the ESA protects multiple species and populations of fish and wildlife, including the endangered Sacramento River winter-run Chinook salmon, California clapper rail, California least tern and salt marsh harvest mouse; and the threatened Central Valley spring-run Chinook salmon, the threatened Central Valley Steelhead, Southern population of North American green sturgeon, delta smelt, California tiger salamander, giant garter snake and California red-legged frog. In 2004, the FWS and NMFS issued non-jeopardy biological opinions for the operation of the CVP and SWP. These opinions were challenged in separate lawsuits, and found inadequate for various reasons. Subsequently FWS and NMFS issued jeopardy biological opinions in 2008 (USFWS Biological Opinion 2008 Biological Opinion for delta smelt) and 2009 (NMFS Biological Opinion and Conference Opinion on the long-term operations of the State Water Project and the Central Valley Project) which each contained an RPA with various actions for the projects to carry out, as well as reduced pumping operations for the protection of the species during various life stages. Though these subsequent biological opinions have also been challenged and FWS and NMFS have been ordered by the federal district court to re-write them, the biological opinions are still in effect, and the projects operate in accordance with them.

1A.6.3 California Endangered Species Act

The California Endangered Species Act (CESA) (Fish and Game Code Sections 2050 to 2089) establishes various requirements and protections regarding species listed as threatened or endangered under state law. California's Fish and Game Commission is responsible for maintaining lists of threatened and endangered species under CESA. CESA prohibits the "take" of listed and candidate (petitioned to be listed) species (Cal. Fish and Game Code, § 2080). "Take" under California law means to "…hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch capture, or kill…" (Cal. Fish and Game Code, 86). The state definition does not include "harm" or "harass," as the federal ESA definition does. As a result, the threshold for take under CESA is typically higher than that under the federal ESA. In accordance with Section 2081 of the California Fish and Game Code, a permit from CDFW is required for projects that could result in the incidental take of a wildlife species state-listed as threatened or endangered. In 2011, CDFW determined that the FWS biological opinion, including its incidental take statement was consistent with CESA under Section 2080.1 of the California Fish and Game Code (Tracking Number 2080-2011-022-00). In

2012, CDFW found that the NMFS biological opinion was consistent with CESA (Tracking Number 2080-2012-005-00).

1A.6.4 Water Rights

California has a dual system of water rights, one for riparian rights holders and one for holders of rights to appropriate surface water from rivers, streams, lakes and underground channels. A landowner whose parcel borders a river has a riparian right to use water from that river on his land. Riparian rights are normally not lost even if not used. California law also allows surface water to be diverted from one point and used (appropriated) beneficially at a separate point. This appropriative right is based on physical control, beneficial use, and, if initiated after 1914, on a permit or license. Appropriative rights are entitlements to a specific amount of water with a definite date of priority. They depend upon continued use and may be lost by non-use. Additionally, appropriative rights may be sold or transferred. Unlike riparian rights, long-term storage of water is considered an acceptable exercise of an appropriative right. However, newly acquired permits for appropriative rights cannot interfere with existing riparian or senior appropriative rights.

Numerous parties hold rights to divert water from the Delta and its upstream tributaries. DWR's SWP, Reclamation's CVP, and other water rights holders divert water from the Delta under appropriative rights. More than 1,000 siphons and pumps are used to divert water from Delta channels under riparian and appropriative rights.

Various water quality and flow objectives have been established by the SWRCB to ensure that the quality of Delta water is sufficient to satisfy all designated uses. Implementation of these objectives requires that limitations be placed on Delta water supply operations, particularly operations of the SWP and CVP, affecting amounts of fresh water and salinity levels in the Delta.

The two largest diverters of Delta water are the State and the federal government for the SWP and CVP, respectively. Diversion and storage of water in upstream reservoirs by the SWP and the CVP, and diversion and export of water from the Delta are authorized and regulated by the SWRCB under appropriative water rights. The third largest diverter of Delta water is Contra Costa Water District. Several municipal users (e.g., Antioch, Mountain House) and many agricultural users also divert water from the Delta under riparian and appropriative rights.

1A.6.5 Delta Water Transfers

A water transfer is a reallocation of water among water users. Water transfers provide much needed flexibility in the allocation and use of water in California. The Governor's Commission on Water Right recognized the importance of water transfers to the future of California's water supply and made a recommendation in its 1976 report regarding the need for specific changes to the Water Code to facilitate the transfer of water.

Over time, language was added to the Water Code to expedite the review and processing of short-term (lasting less than one year) water transfers. Additionally, state and federal agencies have developed procedures to assist in the processing of water transfers proposed by local or private entities. For example, Reclamation accommodates water transfer requests within the CVP through the provisions of the Central Valley Project Improvement Act (CVPIA). DWR allows use of its SWP facilities by its contractors and others under the provisions of Water Code section 1810[5]. Access to pumping plants in the Sacramento–San Joaquin Delta and canal capacities are integral to being able to accomplish water transfers from the northern portions of the State to the central and southern areas of California where the water is most needed.

1A.6.5.1 Lower Yuba River Accord

The most recent long-term transfer arose out of the Lower Yuba River Accord (Yuba Accord) in April of 2005. This collaborative proposal settled long-standing litigation over in-stream flow requirements in the lower Yuba River. The Accord is based on three proposed agreements: a water purchase agreement, including a long-term transfer of about 60 TAF to DWR for the EWA; a conjunctive use agreement; and a fisheries agreement that includes increased minimum flows for fish habitat protection.

The SWRCB approved two one-year pilot programs for the Yuba Accord. The 2006 pilot program established minimum in-stream flows that exceeded state and federal requirements for the lower Yuba River Chinook salmon and steelhead. All 17 conservation groups, agricultural interests, and state and federal agencies participating in the Yuba Accord supported the 2006 pilot program. In late 2006, the Yuba Accord pilot program formally took effect. The EWA purchased 62,000 af of water from the Yuba County Water Agency in 2006, but none of the water could be delivered because of excess conditions in the Delta. The purchase will be delivered when Delta conditions allow for it. After the second successful one-year pilot program in 2007, the SWRCB, in 2008, amended the Yuba County Water Agency’s water rights in order to implement the Yuba Accord.

1A.7 Environmental Programs

In order to mitigate or reverse environmental issues caused by development in the Delta as well as operation of the state and federal projects, attempts have been made by various agencies to develop and implement programs to avoid, minimize, or offset adverse environmental impacts resulting from construction and operation of the water project facilities.

1A.7.1 Central Valley Project Improvement Act

On October 30, 1992, the President signed into law the Reclamation Projects Authorization and Adjustment Act of 1992 (Public Law 102-575) that included Title XXXIV, the Central Valley Project Improvement Act (CVPIA). The CVPIA amends previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses, and fish and wildlife enhancement as a project purpose equal to power generation.

[5] Water Code section 1810 allows a party transferring or exchanging water to use available capacity within an existing water conveyance or distribution facility in exchange for fair compensation subject to various considerations.

Among the major changes mandated by the CVPIA are the following:

- Dedicating 800,000 af annually to fish, wildlife, and habitat restoration (Section 3406(b)(2)).
- Authorizing water transfers outside the CVP service area (Section 3405(a)).
- Implementing an anadromous fish restoration program (Section 3406(b)(1)).
- Creating a restoration fund financed by water and power users (Section 3407).
- Providing for the Shasta Temperature Control Device (Section 3406(b)(6)).
- Implementing fish passage measures at the Red Bluff Diversion Dam (Section 3406(b)(10)).
- Planning to increase the CVP yield (Section 3408(j)).
- Mandating firm water supplies for Central Valley wildlife refuges (Section 3406(d)).
- Meeting federal trust responsibility to protect fishery resources (Trinity River) (Section 3406(b)(23)).

The impacts associated with the CVPIA have been analyzed in a Final EIS that was released in October 1999. The CVPIA ROD was signed on January 9, 2001.

Operations of the CVP reflect provisions of the CVPIA, particularly Sections 3406(b)(1), (b)(2), (b)(3) and (b)(9). The Department of the Interior Decision on Implementation of Section 3406 (b)(2) of the CVPIA, dated May 9, 2003 provides the basis for implementing upstream and Delta actions with CVP delivery capability.

Proposed operations also include allocation of water to wildlife refuges through the CVPIA (Section 3406(d)).

1A.7.2 DWR/CDFW Delta Fish Agreement (formerly known as Delta Pumping Plant Fish Protection Agreement and Four Pumps Agreement)

In 1986, DWR and CDFW (at the time, DFG) entered into the Delta Fish Agreement (DFA), a cooperative agreement to mitigate for losses of striped bass, steelhead trout and salmon fisheries directly caused by the SWP pumps. Under this agreement, DWR must mitigate for fish lost at the SWP pumps, including the impacts of adding four new pumps to that facility. Fish screens and other bypass facilities in place since the 1970’s are in place to divert fish away from the pump; however, significant losses still occur as a result of screen inadequacies, predation in Clifton Court Forebay, and handling as fish are trucked to release sites in the Delta.

Since 1986, approximately $60 million in combined funding has been approved through this agreement for over 40 fish mitigation projects. These projects have included screening of unscreened water diversions, seasonal barriers to guide salmon away from undesirable spawning habitat, and salmon and steelhead hatchery production projects. The agreement has been amended three times to increase funding. In July of 2005, DWR and CDFW (then, CDFG) expanded the scope of the agreement to establish a separate fund of $2.5 million to address near-term pelagic fish issues related to the POD.

In May 2007, DWR and CDFW (then, CDFG) entered into a Memorandum of Understanding (MOU) to begin negotiations to amend the 1986 Four Pumps Agreement to address direct and indirect take of delta smelt and indirect take of salmon, and methods to develop mitigation credits for this take. These agreements now include mitigation considerations for the longfin smelt. The 2008 Amendment is intended to address the impacts associated with the operation of the Banks pumping plant on native species (winter-run Chinook salmon, spring-run Chinook salmon, delta smelt and longfin smelt) after all feasible operational actions have been implemented to minimize or avoid direct and indirect impacts.

DFW and DWR, in cooperation with other state and federal agencies and public interest groups, have been working on mitigation projects to restore populations of these fish by rearing and stocking fish, fish hatchery modernizations, spawning gravel replacement, stream flow enhancement and other projects.

1A.7.3 Trinity River Studies

In October 1984, USFWS began a 12-year study to describe the effectiveness of increased flows and other habitat restoration activities on restoring fishery populations in the Trinity River. The original EIS/EIR evaluated alternatives to restore and maintain natural production of anadromous fish in the Trinity River mainstem, downstream of Lewiston Dam, and was circulated as a public draft in October of 1999. This draft was finalized in October of 2000, culminating in a signed ROD in December of 2000 that outlines a plan for restoration of the Trinity River and its fish and wildlife populations. The restoration strategy is now in the implementation phase, and includes direct in-channel actions, continued watershed restoration activities, replacement of bridges and structures within the floodplain, and a rigorous program to monitor and improve restoration activities. Historically, an average annual quantity of approximately 1.3 MAF of water has been diverted from the Trinity River to the Sacramento River system (1964–1992). A change in the Trinity River flow requirements and a corresponding change in the amount of water diverted to the Sacramento River system may affect future flows to the Delta.

1A.7.4 San Joaquin River Agreement

The 1995 WQCP included water quality and flow objectives for the San Joaquin River Basin. The flow objectives were a source of dispute because the San Joaquin River stakeholders were not represented in the negotiations that established the objectives (1994 Bay-Delta Accord). They also disputed the scientific information regarding the relationship of flow to salmon survival. As a result, an association of water users on the San Joaquin River system filed suit against the SWRCB, challenging the flow objectives contained in the WQCP.

In an effort to settle this issue out of court, the San Joaquin River interests collaborated with other water users, environmental groups and government agencies to identify feasible, voluntary, actions to protect the San Joaquin River's fish resources and implement the SWRCB's objectives. Initial meetings, started in 1996, culminated in an agreement with the Delta water export interests. This agreement is known as the Letter of Intent to Resolve San Joaquin River Issues.

In this agreement, fishery biologists from state and federal agencies and other stakeholders outlined a program of study to gather the best available scientific information on the impact of flows and SWP/CVP export rates on salmon smolt survival in the lower San Joaquin River. The result of this study was a scientific adaptive fishery management plan commonly known as the Vernalis Adaptive Management Plan (VAMP). In addition, the VAMP intended to evaluate what impact the Head of Old River Barrier has on salmon smolt survival.

The San Joaquin River stakeholders recognized the value of implementing VAMP, as well as taking other actions to help implement the 1995 WQCP. This recognition led to the development of the San Joaquin River Agreement (SJRA) which provided funding for water and biological monitoring. A Statement of Support for the San Joaquin River Agreement was signed by most of the parties to the negotiations, committing them to the program once all environmental and regulatory procedures required by the NEPA, CEQA, and SWRCB were complete.

The San Joaquin River Group Authority, Reclamation, and the USFWS adopted the final *EIS/EIR for Meeting Flow Objectives for the San Joaquin River Agreement, 1999–2010*. Reclamation issued a ROD in February 1999. The SWRCB adopted D-1641 on December 29, 1999, subsequently revised on March 15, 2000, providing for implementation of the Agreement. The agreement expired in 2010.

1A.7.4.1 Head of Old River Fish Barrier (HORB)

DWR and participating agencies use temporary fish barriers as a tool to facilitate the following goals:

- Improve water supplies for South Delta water diverters.
- Improve water quality conditions in the Stockton Deep Water Channel.
- Prevent young Chinook salmon from entering the Old River, thereby reducing the likelihood of entrainment at the South Delta facilities.

In 2006, a temporary barrier was not installed at the head of the Old River in spring or fall due to high flows on the San Joaquin River. When installed, the spring season barrier helps improve conditions for juvenile Chinook salmon migrating out of the San Joaquin River Basin. The fall barrier, on the other hand, helps with low dissolved oxygen (DO) levels in the lower San Joaquin River and prevents migrating adult Chinook salmon from entering the Old River while allowing them to continue down the main stem of the San Joaquin River. Temporary agricultural barriers are installed to increase water levels in the South Delta for local water users. In 2006, barriers were installed at Middle River from July 7th to November 18th, at the Old River near Tracy from July 17th to December 8th, and at the Grant Line Canal from July 20th to December 6th. Agricultural barriers are removed in late fall due to the lack of need for irrigation water and possible conflicts the barriers may cause with migrating Chinook salmon.

Due to the concerns for the protection of delta smelt, a physical barrier was not installed in 2008 or in 2009 at the head of the Old River. In 2009, however, DWR, in cooperation with Reclamation, began the initial testing of a non-physical behavior barrier at the head of the Old River. At the same time, DWR was conducting a complementary study on the effects of South Delta temporary barriers on juvenile salmon. Many of the receivers used in these studies were established to complement the VAMP study, thus providing a better picture of the salmon smolt route selection and survival through key channels within the interior of the South Delta. Receiver locations for the VAMP study were coordinated with these two studies to ensure that the maximum amount of data is available to all three studies and that no duplication of effort takes place. In addition, the VAMP fish releases were also coordinated to complement these studies.

1A.7.4.2 San Joaquin River Restoration Program

The San Joaquin River Restoration Program (SJRRP) is a comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of Merced River and restore a self-sustaining Chinook salmon fishery in the river while reducing or avoiding adverse water supply impacts from restoration flows.

The SJRRP is a direct result of a Settlement reached in September 2006 on an 18-year lawsuit to provide sufficient fish habitat in the San Joaquin River below Friant Dam near Fresno, California, by the U.S. Departments of the Interior and Commerce, the Natural Resources Defense Council (NRDC), and the Friant Water Users Authority (FWUA). The Settlement received Federal court approval in October 2006. Federal legislation was passed in March 2009 authorizing Federal agencies to implement the Settlement.

The Settlement is based on two goals:

- Restoration: To restore and maintain fish populations in "good condition" in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.
- Water Management: To reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement (San Joaquin River Restoration Program 2011).

1A.8 Delta Governance and Comprehensive Delta Planning

1A.8.1 Delta Protection Act

In September of 1992, the California Legislature declared that the Sacramento–San Joaquin Delta, consisting of approximately 738,000 acres, is a natural resource of statewide, national, and international significance, containing irreplaceable resources, and that it is the policy of the State to recognize, preserve, and protect those resources for the use and enjoyment of current and future generations.

Recognizing the possible threat to Delta resources from urban encroachment, having the potential to significantly impact agriculture, wildlife habitat, and recreation uses, former Senator Patrick Johnston sponsored SB 1866, leading to the adoption of the Delta Protection Act. The Act, which is often referred to as the Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992, was signed by the Governor on September 23, 1992, with subsequent amendments in 1996, 1998, 1999, and 2000. It is codified in the State Public Resources Code beginning with Section 297000.

The Act includes mandates for the designation of primary and secondary zones within the legal Delta, creation of a Delta Protection Commission, and completion of a Land Use and Resource Management Plan for the Primary Zone.

1A.8.1.1 Delta Protection Commission

The Delta Protection Act of 1992 provides for regional coordination by establishing the 23-member Delta Protection Commission (the Commission). The Commission's diverse composition affords opportunities for stakeholder representation in the areas of agriculture, habitat, and recreation. As specified in the Act, members of the Commission include: landowners from north, south, west, and central Delta reclamation districts; a member of the County Board of Supervisors from each of the five Delta counties (Sacramento, San Joaquin, Contra Costa, Yolo and Solano); a representative from the Sacramento Area Council of Governments (SACOG), San Joaquin Council of Governments (SJCOG), and the Association of Bay Area Governments (ABAC); high level leaders from CDFW, and state departments of Parks and Recreation, Boating and Waterways, Water Resources, Food and Agriculture, and the State Lands Commission; and Delta residents or landowners in the areas of production agriculture, outdoor recreation, and wildlife conservation.

The Commission is to develop a long-term resources management plan for the Delta Primary Zone. As called for in the Act, a Land Use and Resource Management Plan (LURMP) for the Primary Zone of the Delta was prepared and adopted by the Commission in 1995 and revised in 2002. The goals of this regional plan are to "protect, maintain and, where possible, enhance and restore the overall quality of the delta environment." The LURMP sets out findings, policies, and recommendations resulting from background studies in the areas of environment, utilities and infrastructure, land use, agriculture, water, recreation and access, levees, and marine patrol/boater education/safety programs.

As provided in the Act, local government general plans are to be consistent with the provisions of the LURMP. The Commission serves as an appeal body in the event an action of a local entity on a project within the Primary Zone is challenged as being inconsistent with the Act or the LURMP. In 2009, SBX7-1 reduced the composition of the existing Delta Protection Commission from 23 members to 15 members. Additionally, the Commission was charged with reviewing and amending the "Delta Plan" every 5 years.

1A.8.2 Bay-Delta Accord

On December 15, 1994, the Bay-Delta Accord, a state/federal agreement on Bay-Delta environmental protection, was signed. The Accord was the result of over 12 months of scientific analysis and multi-interest negotiations. In the end, a broad range of stakeholder groups, including environmental organizations, business groups, and urban and agricultural water agencies, from throughout California signed or supported the Accord. In December of 1997, state and federal representatives agreed to extend the Accord an additional year to allow CALFED, the cooperative state-federal planning effort created after water and environmental stakeholders and state and federal officials agreed to the landmark 1994 Bay-Delta Accord, sufficient time to complete its work toward a comprehensive solution for the estuary.

The signing of the Bay-Delta Accord was a landmark event that ushered in a new era in California water management. It signaled a stakeholder policy shift, away from numerous lawsuits of the previous two decades, to an attempt to form a collaborative effort to craft a viable long-term solution for the Bay-Delta.

The Accord established interim Bay-Delta standards supported by both state and federal governments. It committed water users to provide money and water for the improvement of the Bay-Delta ecosystem, and in return guaranteed a three-year reprieve from additional species protection requirements. Many of the Accord's standards were adopted by the SWRCB in the 1995 Water Quality Control Plan (WCQP) and implemented through D-1641.

The agreement also gave life to a long-term planning process aimed at finding comprehensive solutions to environmental and water supply problems in the Bay-Delta. That process, known as the CALFED Bay-Delta Program, was also a collaborative, state/federal effort, which additionally identified a package of projects and programs needed to restore the Bay-Delta's ecosystem and improve water supply reliability and water quality.

1A.8.3 CALFED Bay-Delta Program

The groundwork for many of these programs was laid by CALFED. The CALFED Bay-Delta Program was designed to address the complex issues that surround the Bay-Delta and is a cooperative interagency effort involving 25 state and federal agencies with management or regulatory responsibilities for the Bay-Delta. The establishment of the CALFED Bay-Delta Program represents state and federal government in partnership, and launched the largest, most comprehensive water management program in the world.

CALFED was a 30-year plan guided by four major resource management objectives for achieving a Delta that has a healthy ecosystem and can supply Californians with the water they need: water supply reliability, ecosystem restoration, water quality, and levee system integrity. As a way of sustaining CALFED's long-held approach of fulfilling its objectives in a concurrent and balanced manner, these objectives are further addressed through 11 program elements: water management, storage, conveyance, ecosystem restoration, environmental water account, levee system integrity, watershed management, water supply reliability, water use efficiency, water quality, water transfers, and science.

On August 28, 2000, Reclamation, DWR, and other state and federal agencies committed to implementing a long-term plan to restore the Bay-Delta, in the CALFED Bay-Delta Program (CALFED) ROD upon certification of a programmatic EIR/EIS. The ROD describes a strategy for implementing an overall plan to fix the Delta and identifies complementary actions the CALFED agencies will also pursue in coordination with the plan's programs and in support of the stated goals. Nothing in the ROD was intended to, nor did it, affect the regulatory responsibilities of individual CALFED agencies. In 2005, a legal action challenging the ROD was upheld in favor of the ROD. This decision was later overturned by the court of appeals. In 2008, the California Supreme Court affirmed the lower court's decision that the programmatic document was legally adequate.

The California Bay-Delta Act of 2003 established the California Bay-Delta Authority (Authority) as the new governance structure and charged it with providing accountability, ensuring balanced implementation, tracking and assessment of the CALFED Bay-Delta Program progress, using sound science, assuring public involvement and outreach, and coordinating and integrating related government programs.

In January 2010, as part of the 2009 California water legislative package, the Act was repealed. Simultaneously, the legislation transferred the responsibilities and authorities of the Authority to the newly created Delta Stewardship Council (Council). The Council was given the authority to "administer all contracts, grants, easements, and agreements made or entered into by the California Bay Delta Authority." It further provided that all contracts entered into by the Authority were not void or voidable, but would continue until the end of the term. Finally, the Council was given "all of the administrative rights, abilities, obligations and duties of the Authority."

The Act expressly did not modify the program authority of participating agencies, like the Department of Water Resources or the Department of Fish and Wildlife, as those departments retained all of their existing powers. Nor did the Act mandate that these departments carry out any specific activity, as those remained under the existing authorities of each department. Thus any obligations agreed to by the CALFED agencies were unaffected by the passage of the Act in 2003 or its repeal in 2010.

New long-term planning efforts are described below.

1A.8.4 Sacramento–San Joaquin Delta Vision

In September 2006, Governor Schwarzenegger signed Executive Order S-17-06, which launched the Delta Vision process by establishing a Blue Ribbon Task Force, a cabinet-level Delta Vision Committee, Delta Science Advisors, and a Stakeholder Coordination Group. The executive order charged the Blue Ribbon Task Force with developing both a long-term vision for a sustainable Delta and a plan to implement that vision. The task force completed its vision for the Delta in January of 2008, and its strategic plan in October of 2008. The executive order charged the cabinet-level Delta Vision Committee with reviewing the completed work of the task force and making its own implementation recommendations to both the Governor and Legislature by December 31, 2008.

1A.8.4.1 Blue Ribbon Task Force

A key component of Delta Vision was the Governor's appointment of an independent Blue Ribbon Task Force that would be responsible for recommending future actions to achieve a sustainable Delta.

- The Task Force members would be persons with demonstrated experience and expertise in addressing and resolving complex natural resource management issues involving significant economic and governance issues.
- Task Force recommendations would not be constrained by past decisions or policies relating to the Delta, and would benefit by the advice of science advisors selected by the Delta Vision Committee.
- The Task Force would convene in public meetings and be supported by input from local governments, technical and scientific advisors, and a Stakeholder Coordinating Group.
- Science advisors and the Stakeholder Coordinating Group would be selected by the Delta Vision Committee created by the Governor as part of Executive Order S-17-06. The Delta Vision Committee included the Secretary of Resources as chair, and the Secretaries of Business, Transportation and Housing; the Department of Food and Agriculture and the Cal-EPA; and the president of the California Public Utilities Commission.
- The Task Force would submit recommendations to the Delta Vision Committee by October 31, 2008, and the Delta Vision Committee would review task force recommendations and report its findings to the Governor.
- Based on the work of the task force and the Delta Vision Committee, the Governor would submit a report to the legislature by December 31, 2008.

1A.8.4.2 Delta Strategic Plan

The Delta Strategic Plan identified and evaluated alternative implementing measures and management practices that would be necessary to implement Delta Vision recommendations. The final Task Force strategic plan recommendations were submitted to the public and the Delta Vision

Committee by October 31, 2008. A report on the final Delta Strategic Plan was submitted by the Delta Vision Committee to the Governor and the Legislature on January 2, 2009.

The Delta Vision Committee recommended that the State manage the Delta according to two co-equal goals: "Restore the Delta ecosystem and create a more reliable water supply for California." The Committee also recommended that the Legislature incorporate these goals into state law. Recognizing the Delta as a unique and valuable place, however, the Delta Vision Committee also recommended actions to protect the Delta's unique characteristics and strengthen the Delta's emergency preparedness. Finally, the Delta Vision Committee recommended actions to govern the Delta in a way that would achieve these goals.

Many of the recommendations made by the Blue Ribbon Task Force in the Delta Strategic Plan were later incorporated into the 2009 Comprehensive Water Package.

1A.8.5 Delta Risk Management Strategy

In the spring of 2006, the Department of Water Resources initiated a two-year "Delta Risk Management Study" (DRMS) to analyze risks to the levee system. The DRMS was an outgrowth of the Management Program Element described in the CALFED ROD. The purpose of the DRMS was to analyze and quantify the risk of levee failures in the Delta. It was also intended to provide a set of alternative plans to reduce the risk of levee failures that would be considered in subsequent decision and implementation initiatives, such as Delta Vision and the USACE CALFED Levee Stability Program. Risk reduction measures that would be common to all possible alternatives would be recommended for immediate implementation.

The 2000 CALFED Programmatic ROD presented its Preferred Program Alternative, which described actions, studies, and conditional decisions to help fix the Delta. As part of the Preferred Program Alternative, the DRMS would assess major risks to Delta resources from floods, seepage, subsidence, climate change, and earthquakes for a Stage 1 implementation.

The DRMS' objectives were twofold. First, the study evaluated potential impacts to the Sacramento–San Joaquin Delta and related assets that could result from various potential stressing events. Second, DRMS developed a report, which outlined options or strategies to protect and reduce risk to Delta assets and related beneficiaries.

The purposes of the DRMS were to evaluate ongoing and future risks of levee failure, identify probable consequences, and identify levee maintenance and upgrades that were necessary and economically justified to reduce risk. Data gained from this critically important study would help establish the priorities for near and long-term actions that would reduce risks associated with catastrophic levee failure in the Delta.

DRMS provided important technical information on not only the probability of Delta levee failures, but also the consequences of failed levees on the Delta and water export regions. DRMS Phase I, which was quantification of the risk of Delta levee failures, was completed in July 2007; Phase II, which was identification of risk reduction measures, was released in June 2011.

1A.8.6 2009 Comprehensive Water Package

On November 4, 2009, the California State Legislature passed a wide-ranging water package, Legislative Bills SBX7, aimed primarily at addressing the State's aging water infrastructure, future water supply issues throughout California regions, and the environmental plight of the Sacramento–San Joaquin Bay-Delta. The package included an $11.14 billion bond proposal to fund drought relief, water supply reliability, Delta sustainability, statewide water system operational improvements, conservation and watershed protection, groundwater protection, and water recycling and water conservation programs. Initially the bond was scheduled to go before voters in November of 2010, but the Legislature voted to postpone the vote. The bill package was intended to improve planning in the Bay-Delta area and to set up mechanisms by which future decisions about water supply and allocation can be balanced with ecological concerns. In addition, the legislation includes measures that aim to improve groundwater monitoring and record keeping on water diversion activities, promote water conservation, and require more efficient use of water by the urban and agricultural sectors.

The 2009 Comprehensive Water Package consists of a five-bill package:

- Senate Bill 1 (SBX7-1): Delta Governance and Management.
- Senate Bill 2 (SBX7-2): Water Bond Measure.
- Senate Bill 6 (SBX7-6): Groundwater Monitoring.
- Senate Bill 7 (SBX7-7): Water Conservancy.
- Senate Bill 8 (SBX7-8): Water Rights Enforcement.

1A.8.6.1 Delta Stewardship Council and the Delta Plan

The Delta Stewardship Council was created by SBX7-1, which made comprehensive changes to the governance of the Delta. The bill established that the Delta Stewardship Council has jurisdiction over land use projects in the Delta area. The Delta Stewardship Council is composed of members who represent different parts of the State and offer diverse expertise in fields such as agriculture, science, the environment, and public service. Of the seven members, four are appointed by the Governor, one each by the Senate and Assembly, and the seventh is the chair of the Delta Protection Commission. In addition, they are advised by a 10-member board of nationally and internationally renowned scientists.

The mission of the Delta Stewardship Council is to achieve coequal goals through development of a Delta Plan[6]. As stated in the California Water code, "'Coequal goals' means the two goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place" (CA Water Code § 85054). The Delta Plan is a comprehensive, long-term management plan to achieve these goals for the Delta and it is anticipated to be one of the most complex and comprehensive planning efforts in the State's history. The Delta Plan and an EIR have also been prepared with the purpose of obtaining approval, under federal law, that the Delta Plan is consistent with the Coastal Zone Management Act. The Delta Plan EIR is programmatic in nature due to the broad nature of the Delta Plan. Future environmental documents will be completed by other agencies when they implement projects that are subject to consistency reviews by the Delta Stewardship Council, or which are encouraged or otherwise influenced by the Delta Plan.

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[6] Part 4 of the Sacramento–San Joaquin Delta Reform Act of 2009 describes the responsibilities of the Delta Stewardship Council with respect to the development of the Delta Plan.

Eight draft versions of the Delta Plan were written between February 2011 and November 2012. The Proposed Final Delta Plan, as well as the Final Delta Plan Program EIR and the Final Rulemaking Package, were adopted by the DSC at its May 16, 2013 meeting. Once the State Office of Administrative Law and California Secretary of State approve the plan, the proposed policies in the Delta Plan will become enforceable regulations. The Proposed Final Delta Plan consists of 14 policies and 73 regulations.

1A.8.6.2 Sacramento–San Joaquin Delta Conservancy

The Sacramento–San Joaquin Delta Conservancy (the Conservancy) was created by SBX7-1 to promote environmental restoration and the economic well-being of the Delta. The Conservancy also leads state efforts that advance environmental protection in the Delta in collaboration and cooperation with local communities, and others, to preserve, protect, enhance and restore the heritage, property, natural resources, economy, and agriculture of the Sacramento–San Joaquin Delta and Suisun Marsh, with particular emphasis on agriculture and increasing opportunities for tourism and environmental education for the benefit of the Delta region, its communities and the State.

The Conservancy also leads efforts that advance environmental protection in the Delta and the economic well-being of Delta residents. The Conservancy's goal is to implement projects that will result in integrated environmental, economic and social benefits. To reach that goal, the Conservancy works in collaboration with local communities, interested groups and state and federal agencies to seek creative opportunities to address challenges and reach agreement for moving these efforts forward. The Conservancy strives to ensure that programs and projects are prioritized and funded in a balanced manner according to geography and its legislative responsibilities.

To identify local needs and develop long-term partnerships, the Conservancy held public workgroups to help develop goals, criteria, priorities and performance measures for each of its mandated areas. A final strategic plan was completed in June 2012 which will direct future projects and activities.

1A.8.6.3 Bay Delta Conservation Plan

The proposed BDCP is a unique undertaking by DWR and other public water agencies to provide for long-term sustainability of the Delta. The BDCP sets out a comprehensive long-term strategy for the Delta designed to restore and protect ecosystem health, water supply, and water quality within a stable regulatory framework. This EIR/EIS describes in detail and analyzes the proposed BDCP.

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