



**Chapter 7**  
**Cumulative**  
**Impacts Assessment**



## 7. Cumulative Impacts Assessment

This chapter of the Draft PEIR provides an assessment of the WHCP's potential to contribute to cumulative impacts in the Delta region. Section 15130 of the CEQA guidelines require that an EIR discuss the cumulative impacts of a project when the project's incremental effect is cumulatively considerable.

Section 15355 of the CEQA guidelines defines cumulative impacts as follows: "Cumulative impacts refer to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts. The individual effects may be changes resulting from a single project or number of separate projects. The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time."

There are two possible approaches to discussing significant cumulative impacts. The first approach, utilized in this Draft PEIR, is to use a list of past, present, and probable future projects producing related or cumulative impacts. The second approach is to utilize projections in an adopted general plan or planning document. Within the first approach, factors to consider when determining whether or not to assess a related project include: the nature of each environmental resource being examined, location of the project, and type of project.

This chapter identifies related projects, and provides a discussion of potential cumulative impacts. The chapter is organized as follows:

- A. Related Project Summaries*
- B. Assessment of Cumulative Impacts.*

### **A. Related Project Summaries**

There are numerous large and small-scale projects in the Delta related to resource conservation, endangered species, restoration, water conveyance, water quality, and water use. Many of these projects have been in operation for several years, while others are in the early stages of planning and environmental permitting. In developing this summary of past, current, and future projects, we primarily utilized the July 2009, Delta-Mendota Canal/California Aqueduct Interim EIS, and the August 2008, Biological Assessment on the Continued Long-Term Operations of the Central Valley Project and the State Water Project, as well as other environmental documentation and project summaries.

Most Delta-wide projects are of far greater scope than the WHCP. For example, several of the projects described in this chapter involve significant Delta-wide operations that will influence Delta hydraulics and fisheries. None of the prior Delta EIRs or EISs reviewed for this PEIR (with the exception of the EDCP EIR) even considered the WHCP or EDCP in their cumulative impacts assessment. This suggests to the DBW that as compared to other Delta projects, the environmental impacts of the WHCP are immaterial.

Below, we describe 33 past, present, and possible future projects (not including the WHCP) with which the WHCP may potentially contribute to cumulative impacts. We categorize these projects based on their implementation time period: (1) Existing Delta Projects, (2) Near Future Delta Projects, (3) Longer-Term Future Delta Projects, and (4) Terminated Delta Projects. Near future Delta projects are in construction or planning phases, with significant probable action expected in the next few years. Longer-term future Delta projects are earlier in the planning phases. Terminated Delta projects include projects that were past projects, and projects that were planned, but at this point in time are no longer likely to be implemented.

### 1. Existing Delta Projects

#### **Egeria densa Control Program (EDCP)** ①

The DBW operates the *Egeria densa* Control Program, as well as the WHCP. *Egeria densa* (Brazilian Waterweed) is a fast growing submerged invasive aquatic plant that has a significant impact on shallow-water habitat in the Delta. In the past 45 years since *Egeria densa* was introduced into the Delta, it has infested approximately 10,000 of the 55,000 surface acres of the Delta. *Egeria densa* crowds out native plants, slows water flows, entraps sediments, obstructs waterways, impedes anadromous fish migration patterns, and clogs water intakes.

In 1997, AB 2193 amended the California Harbors and Navigation Code (Chapter 2, Article 2, Section 64) to designate the DBW as lead agency for control of *Egeria densa* in the Delta, its tributaries, and Suisun Marsh. The DBW prepared an EIR for the EDCP in 2001, and has operated the EDCP since the 2001 treatment season. The EDCP operates under the same NPDES General Permit for Aquatic Pesticides Use (CAG 990005) as does the WHCP. In addition, the EDCP operates under USFWS and NOAA-Fisheries biological opinions with similar requirements as the WHCP biological opinions.

The EDCP essentially operates in parallel to the WHCP, with the same time periods, monitoring, and permit requirements. In 2008, the EDCP utilized only one herbicide, fluridone, although DBW used three different formulations of this chemical. After several years of limited efficacy, the DBW implemented a new approach in 2007 and 2008, with extensive treatments in one nursery area, Franks Tract. In 2008, the DBW treated 2,571 acres within Franks Tract between April 7<sup>th</sup> and May 31<sup>st</sup>. The treatment protocol was designed to maintain between 1 and 10 ppb of fluridone in the water column during the treatment period.

DBW conducted Fastest (immune-assay) testing and residue sampling for fluridone levels. All but five receiving water residue samples had non-detectable levels of fluridone, and the five samples with detectable levels were orders of magnitude below the maximum receiving water residue limit of 560 ppb (all five samples were less than 2 ppb). In addition, Fastest samples were taken within and adjacent to Franks Tract to ensure that residue levels did not exceed the target concentration levels, or levels established by NOAA-Fisheries in the biological opinion. The maximum Fastest sample was 17.5 ppb, and most samples were less than 5 ppb.

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The EDCP nursery area treatment approach was effective in reducing *Egeria densa* bio-cover, and bio-volume in Franks Tract. As a result, the DBW is continuing this focused treatment-area approach for the EDCP, expanding to a new nursery area in the eastern Delta in 2009. This focused approach means that, rather than treat numerous sites spread throughout the Delta, material EDCP herbicide treatments occur in only one, or perhaps two, locations during a treatment season.

The DBW's December 2006, *Second Addendum to 2001 Environmental Impact Report with Five-Year Program Review and Future Operations Plan* identified potentially affected environmental factors for the EDCP. Many of the potentially affected environmental factors are the same potentially affected environmental factors as described for the WHCP. The environmental resource areas with potentially significant impacts resulting from the EDCP include:

- **Agricultural Resources** – avoidable significant impacts to agricultural crops or agricultural operations, such as irrigation.
- **Biological Resources** – unavoidable or potentially unavoidable significant impacts to special status species, wetlands, and movement of native species; avoidable significant impacts to riparian or sensitive natural communities.
- **Hazards and Hazardous Materials** – avoidable significant impacts due to routine transport, use, or disposal; or accidental spill, of hazardous materials.
- **Hydrology and Water Quality** – unavoidable or potentially unavoidable significant impacts due to violation of water quality standards, waste discharge requirements, or otherwise degrading water quality; avoidable significant impacts due to potentially degrading drinking water quality.
- **Utilities and Service Systems** – avoidable significant impacts due to plant fragments blocking water utility intake pumps.

## Central Valley Project (CVP) and State Water Project (SWP) ②

All activities within the Delta occur within the context of the CVP and SWP. The CVP and SWP are two major inter-basin water storage and delivery systems that divert and re-divert water from the southern portion of the Delta. Both the CVP and SWP include major reservoirs upstream of the Delta, and transport water via natural watercourses and canal systems to areas south and west of the Delta.

The USBR and DWR operate the CVP and SWP to divert, store, and convey water consistent with applicable law and contractual obligations. The Coordinated Operations Agreement (COA) defines the project facilities and their water supplies, sets forth procedures for coordination of operations, identifies formulas for sharing joint responsibilities for meeting Delta standards, identifies how unstored flow will be shared, sets up a framework for exchange of water and services, and provides for periodic review of the agreement (USBR August 2008). The Operations Criteria and Plan (OCAP) defines the ongoing operations of the CVP and SWP. The USBR prepared a biological assessment for the OCAP in August 2008.

## Environmental Water Account ③

The Environmental Water Account (EWA) is a two-part cooperative management program to assist in protecting and restoring native fish species, and to increase water supply reliability for CVP and SWP water deliveries (USBR 2003; USBR 2008). Agencies involved in implementing the EWA are: the Department of Water Resources, the Department of Fish and Game, the Bureau of Reclamation, the USFWS, and NOAA-Fisheries. The EWA curtails pumping at CVP and SWP facilities to protect fish, and then purchases water from willing

sellers to replace contract water supplies. The EWA was proposed in the CALFED 2000 Record of Decision (ROD), and an EIR/EIS was completed in 2004. The program was originally scheduled to run through 2007.

The Bureau of Reclamation, USFWS, and NOAA-Fisheries received congressional authorization to participate in the EWA through September 30, 2010, including an emphasis to support the Vernalis Adaptive Management Plan (VAMP). Federal authorization would be required to continue the EWA beyond September 30, 2010. EWA agencies are currently conducting environmental reviews to determine the future of the EWA (USBR August 2008).

### South Delta Temporary Barriers Project 4

The DWR has installed temporary barriers in the South Delta in the spring and/or fall for most years since 1991 (DWR 2008). After the 1991 test project proved successful, the DWR extended the project until 2001, and then until 2010. The project consists of four rock barriers across South Delta channels. The barriers serve as “fish barriers”, to benefit migrating salmon, or “agricultural barriers”, to increase water levels, water quality, and circulation patterns for agricultural users. The DWR monitors impacts of the barriers on water quality and fisheries. In response to the NOAA-Fisheries 2008 biological opinion on the temporary barriers, the DWR is conducting additional monitoring on the potential for predation at the barriers. This analysis will supplement the South Delta Improvement Program environmental documentation (NOAA-Fisheries June 2009).

### USFWS BO – Reasonable and Prudent Alternative 5

The USFWS determined in December 2008 that a Reasonable and Prudent Alternative (RPA) is necessary for the protection of delta smelt

(USBR July 2009). The RPA includes measures to: (1) prevent/reduce entrainment of delta smelt at Jones and Banks Pumping Plants; (2) provide adequate habitat conditions that will allow the adult delta smelt to successfully migrate and spawn in the Bay-Delta; (3) provide adequate habitat conditions that will allow larvae and juvenile delta smelt to rear in the Bay-Delta; (4) provide suitable habitat conditions that will allow successful recruitment of juvenile delta smelt to adulthood; and (5) monitor delta smelt abundance and distribution by continued sampling programs through the IEP. The RPA is comprised of the following actions:

- **Action 1:** To protect pre-spawning adults, exports would be limited starting as early as December 1<sup>st</sup> (depending on monitoring triggers) so that the average daily Old and Middle River (OMR) flows is no more negative than -2,000 cfs for a total duration of 14 days.
- **Action 2:** To further protect pre-spawning adults, the range of net daily OMR flows will be no more negative than -1,250 to -5,000 cfs (as recommended by smelt working group) beginning immediately after Action 1 is needed.
- **Action 3:** To protect larvae and small juveniles, the net daily OMR flows will be no more negative than -1,250 to -5,000 cfs (as recommended by smelt working group) for a period that depends on monitoring triggers (generally March through June 30<sup>th</sup>).
- **Action 4:** To protect fall habitat conditions, sufficient Delta outflow will be provided to maintain an average X2 for September and October no greater (more eastward) than 74 km (Chippis Island) in the fall following wet years and 81 km (Collinsville) in the fall following above normal years.
- **Action 5:** The head of Old River barrier will not be installed if delta smelt entrainment is a concern. If installation of the head of Old River barrier is not allowed, the agricultural barriers would be installed as described in the Project Description (of the OCAP BA).

- **Action 6:** A program to create or restore a minimum of 8,000 acres of intertidal and associated subtidal habitat in the Delta and Suisun Marsh will be implemented within 10 years. A monitoring program will be developed to focus on the effectiveness of the restoration program (USBR July 2009, 6-4).

### NOAA-Fisheries BO – Reasonable and Prudent Alternative ⑥

NOAA-Fisheries (also known as National Marine Fisheries Service, NMFS) determined (June 2009) that an RPA was necessary for the protection of salmon, steelhead, and green sturgeon (USBR July 2009). The RPA includes measures to improve habitat, reduce entrainment, and improve salvage, through both operational and physical changes in the system. Additionally, the RPA includes development of new monitoring and reporting groups to assist in water operations through the CVP and SWP systems and a requirement to study passage and other migratory conditions. The more substantial actions of the RPA include:

- Providing fish passage at Shasta, Nimbus, and Folsom Dams
- Providing adequate rearing habitat on the lower Sacramento River and Yolo Bypass through alternation of operations, weirs, and restoration projects
- Engineering projects to further reduce hydrologic effects and indirect loss of juveniles in the interior Delta
- Technological modifications to improve temperature management in Folsom Reservoir.

Overall the RPA is intended to avoid jeopardizing listed species or adversely modifying their critical habitat, but not necessarily achieve recovery. Nonetheless, the RPA would result in benefits to salmon, steelhead, green sturgeon and other fish and species that use the same habitats (USBR July 2009, 6-5).

### Old River and Rock Slough Water Quality Improvement Project ⑦

CCWD completed the Old River and Rock Slough Water Quality Improvement Project in 2006 (USBR July 2009). This project was designed to minimize salinity and other constituents of concern in drinking water by relocating or reducing agricultural drainage in the south Delta. CCWD intake facilities are located on Rock Slough and Old River, which also receive agricultural drainage water discharged from adjacent agricultural lands. Agricultural drainage water can adversely affect water quality entering the CCWD system (USBR July 2009, 6-11).

### CalFed Levees Program ⑧

The goal of the CALFED Levees Program is to uniformly improve Delta levees by modifying cross sections, raising levee height, widening levee crown, flattening levee slopes, or constructing stability berms (USBR July 2009). Estimates predict that there are 520 miles of levees in need of improvement and maintenance to meet the standard for Delta levees. The levees program continues to implement levee improvements throughout the Delta, including the south Delta area (USBR July 2009, 6-14).

### CalFed – Ecosystem Restoration Program Conservation Strategy/ Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) ⑨

As controversies over the Delta and water grew in the early 1990's, Governor Pete Wilson and State and federal agencies established the Delta Accord. The Accord established interim water quality standards, and created CalFed. CalFed was tasked to: (1) develop long-term water quality standards for the Delta, (2) coordinate operations of the CVP and SWP, and (3) develop long-term solutions for the Delta. After several

years of preparation, CalFed was formally established in 2000, with the signing of the Record of Decision (ROD). The State-Federal partnership was tasked to: expand water supplies and ensure efficient water use, improve water quality, improve the health of the Bay-Delta ecosystem, and improve Bay-Delta levees. The partnership has been slow to meet these objectives, and is now operating under a new 10-Year Action Plan, including establishing a strategic planning function and developing program performance measures.

CalFed is developing an Ecosystem Restoration Program (ERP) Conservation Strategy to identify restoration opportunities in the Delta and Suisun Marsh. The strategy will serve as a guidance document for ecosystem restoration, and will incorporate new information on the ecosystem as it is better understood. The first ERP Conservation Strategy will focus on the Delta and Suisun Marsh, and is titled: Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) (CDFG 2008; URS Corporation 2007). The DRERIP will refine and develop new Delta specific ecosystem restoration projects, and will incorporate performance evaluation and adaptive management feedback. The plan is being developed during 2009.

CalFed has developed a DRERIP Scientific Evaluation Process to evaluate draft conservation measures, including those outlined in the Bay Delta Conservation Plan (BDCP). The evaluation process includes criteria for scoring the magnitude of ecological outcomes, and the certainty of ecological outcomes (The Essex Partnership, May 2009).

As stated in the South Delta Improvement Program (SDIP) Draft EIS/EIR, “The CalFed ERP [Ecosystem Restoration Program] actions, when considered with other cumulative Delta projects and actions are intended to improve, in part, Delta habitat and conditions for fish and wildlife. Although implementing ERP actions in the Delta may result in some temporary disturbance of Delta waterways and habitat, it is unlikely that

these effects would substantially affect local or export water supplies. Improvements to Delta aquatic and terrestrial habitats could result in improved water quality and habitat conditions that ultimately would be beneficial to improving local and export water supply reliability” (DWR October 2005, 10-24).

### **Stockton East Water District Efficiency Enhancement Project) ⑩**

The Stockton East Water District began a \$12 million Efficiency Enhancement Project in 2005 to increase the amount of drinking water available for the Stockton urban area (Stockton East Water District 2009). The enhancements include pretreatment system efficiency improvements, a new sedimentation basin and chemical feed system, and retrofits for an existing pump system.

## **2. Near Future Delta Projects**

### **Contra Costa Water District (CCWD) Alternative Intake Project ⑪**

The CCWD will construct a new intake pump at Victoria Canal. Construction began in 2009 (CCWD May 2006; CCWD 2006; CCWD 2009). The project will enable CCWD to relocate some of its existing diversions to Victoria Canal, a Delta location with higher-quality source water than is currently available at its Old River and Rock Slough intakes. The new pump location at Victoria Canal will provide improved drinking water quality to CCWD customers. The new intake pump will not increase total diversions, and will include fish screens, improving long-term benefits to Delta fisheries.

The new intake could result in potentially significant impacts to Delta fisheries and aquatic resources during construction as a result of underwater sound pressure from cofferdam installation, potential chemical spills, and potential

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fish and macroinvertebrate stranding during dewatering of the cofferdam (CCWD May 2006).

The new intake could result in less than significant impacts during construction due to increased sedimentation, turbidity, and contaminants. The new intake could result in less than significant impacts to Delta water resources due to long-term changes in Delta water supplies, potential violations of Delta water quality standards, and potential long-term changes that result in water quality degradation that would affect beneficial uses. The CCWD will implement mitigation measures to reduce these significant impacts.

### **City of Sacramento Water Facilities Expansion Project** ⑫

The City of Sacramento is in the process of expanding and replacing facilities at the E.A. Fairbairn Water Treatment Plant, and the Sacramento River Water Treatment Plant. The City is also considering the eventual construction of a new treatment plant north of the Sacramento International Airport. The City obtained an EIR for a first round of treatment plant expansion in 2000, and made a number of improvements, including a new intake facility on the Sacramento River. In 2009, the City is considering a range of capital improvement projects that will increase the sustainable capacity of the Sacramento plant from the current level of 93 million gallons per day, to 150 million gallons per day. The City also evaluated three expansion alternatives to provide an additional 150 million gallons per day of capacity (City of Sacramento March 2009).

### **Sacramento River and Stockton Deep Water Ship Channels** ⑬

The Sacramento River Deep Water Ship Channel provides a deep-draft channel from Suisun Bay to an inland harbor at Washington Lake, west of the Sacramento River in the City of

West Sacramento. The Stockton Deep Water Ship Channel extends from Suisun Bay into the San Joaquin River and ends at the turning basin in the City of Stockton, a distance of 43 miles. The John F. Baldwin Ship Channel extends from the Golden Gate to Chipps Island (in Suisun Bay). The U.S. Army Corps of Engineers is planning to solicit bids for annual maintenance dredging in the Sacramento River and Stockton Deep Water Ship Channels. The U.S. Army Corps of Engineers is also preparing a feasibility study and EIS/EIR for a San Francisco Bay to Stockton Improvement Study that would evaluate effective, affordable, and environmentally sustainable approaches to improving the navigation efficiency of this transportation artery (U.S. Army Corps of Engineers 2008).

### **Delta Wetlands Project** ⑭

The Delta Wetlands Project, is a private water development project that would divert and store up to 210,000 acre-feet on two islands in the Delta and dedicate two other islands for wetland and wildlife habitat improvements (USBR July 2009). The Delta Wetlands Project was analyzed in environmental documents and permits were issued for the private project in 2001, and an update to those analyses is currently being prepared. As part of the Delta Wetlands Project, Webb Tract and Bacon Island would be converted to reservoirs, and Bouldin Island and Holland Tract would be used as wetland and wildlife habitat per DFG habitat management plans (USBR July 2009, 6-7). The Semitropic Water Storage District is assuming the role of CEQA lead agency for the Delta Wetlands Project EIR. Semitropic published a Notice of Preparation in November 2008 (Delta Wetlands Project 2009).



### San Joaquin River Agreement and Vernalis Adaptive Management Plan (VAMP) <sup>15</sup>

The VAMP is a twelve year experimental management program intended to protect juvenile Chinook salmon in the San Joaquin River, while determining how salmon survival rates change based on alterations in San Joaquin River flows and SWP/CVP exports (CDFG 2008; San Joaquin River Group Authority 2008). The program was initiated in 2000 as part of the San Joaquin River Agreement, and will run until 2012. VAMP consists of implementing a pulse flow in the San Joaquin river for a 31-day period in April/May, and reduced CVP/SWP pumping, to facilitate migration and attraction of anadromous fish. Lead agencies include USFWS, NOAA-Fisheries, and CDFG. The program evaluates salmon survival rates and flows, and determines flow levels based on hydrological conditions in the San Joaquin River watershed. The original agreement was intended to implement the SWRCB 1995 Water Quality Control Plan for the San Joaquin River and San Francisco Bay-Delta Estuary. In 2007, VAMP activities were modified slightly to account for low salmon production at the Merced River Hatchery, and concern over delta smelt abundance.

### San Joaquin River Restoration Program (SJRRP) <sup>16</sup>

The SJRRP will implement the San Joaquin River litigation settlement involving the Natural Resources Defense Council (NRDC), Friant Water Users Authority, the Department of Interior, and NOAA-Fisheries (SJRRP 2007). The program is being implemented by the Bureau of Reclamation, USFWS, NOAA-Fisheries, DWR, and DFG. The goals of the program are to restore and maintain fish populations in “good condition” on the main stem of the San Joaquin River below Friant Dam, and to the confluence of the Merced River, and to reduce or avoid adverse water supply impacts to

Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the settlement.

Federal legislation to fund the SJRRP was signed in March 2009. The program will prepare a Draft EIR/EIS by August 2009, to analyze specific impacts of the settlement. The settlement requires specified releases from Friant Dam to support migration and emigration of spring and fall run Chinook salmon. Interim flows are to begin in fall 2009, and the project will also include structural and channel improvements. Construction is likely to result in significant environmental impacts to biological resources and hydrology and water quality. Total costs are expected to range from \$250 million to \$800 million. The project area falls within WHCP treatment sites currently managed by Merced and Fresno Counties.

### Bay Delta Conservation Plan <sup>17</sup>

This major collaborative planning effort is led by the California Department of Water Resources, California Department of Fish and Game, State Water Resources Control Board, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Services, and NOAA-Fisheries (DWR 2008; Resources Agency 2008). Several water agencies, environmental organizations, and other organizations are also involved. The “purpose of the BDCP is to help recover endangered and sensitive species and their habitats in the Delta in a way that also will provide for sufficient and reliable water supplies.”

The effort was initiated by Governor Schwarzenegger when he requested that the DWR evaluate at least four alternative Delta conveyance strategies in coordination with BDCP efforts to better protect at-risk fish species. The BDCP effort will meet ESA and Natural Community Conservation Planning requirements, and will also include development of an EIR/EIS.

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As outlined in the Notice of Preparation, the BDCP is ultimately intended to “secure authorizations that would allow the conservation of covered species, the restoration and protection of water supply reliability, protection of certain drinking water quality parameters, and the restoration of ecosystem health to proceed within a stable regulatory framework.” Activities under the BDCP will include habitat development, water supply and power generation, facility maintenance, and improvements. The entire BDCP and EIR/EIS process will be completed in late 2010, with draft documents completed in early 2010 (California Natural Resources Agency March 2009).

One of the goals of the project is to reexamine the conveyance alternatives that were analyzed in the CALFED August 2000 documents, based on recent declines in pelagic organisms, particularly delta smelt, increased concern about higher risks from Delta levees due to earthquakes, and potential impacts of climate change. The BDCP stems in part from the Delta Vision’s recommendation that the State should consider different approaches to conveying water through the Delta than the current through-Delta alternative that was approved by the CALFED Record of Decision. The four alternatives that the BDCP Steering Committee is currently considering are:

- Existing through Delta conveyance with physical habitat restoration
- Improved through Delta conveyance with physical habitat restoration
- Dual conveyance, including improved through Delta conveyance and isolated conveyance from the Sacramento River to the south Delta, with physical habitat restoration
- Isolated conveyance from the Sacramento River to south Delta, with physical habitat restoration.

### Franks Tract Project) 18

The DWR and Bureau of Reclamation propose to implement the Franks Tract Project to improve water quality and fisheries conditions in the Delta (USBR July 2009). DWR and Reclamation are evaluating installing operable gates to control the flow of water at key locations (Threemile Slough and/or West False River) to reduce sea water intrusion, and to positively influence movement of fish species of concern to areas that provide favorable habitat conditions. By protecting fish resources, this project also would improve operational reliability of the SWP and CVP because curtailments in water exports (pumping restrictions) are likely to be less frequent. The overall purpose of the Franks Tract Project is to modify hydrodynamic conditions to protect and improve water quality in the central and south Delta, protect and enhance conditions for fish species of concern in the western and central Delta, and achieve greater operational flexibility for pump operations in the south Delta (USBR July 2009, 6-12).

### Two-Gate Project 19

As part of the interim remedy order of December 14, 2007, U.S. District Court Judge Wanger imposed restrictions on reverse flows in the south Delta to protect delta smelt from entrainment at the SWP and CVP export facilities (USBR July 2009). In response, the Two-Gate Project has been proposed by Delta exporters in coordination with the DWR as a physical and operational measure to help reduce potential entrainment under certain conditions and to reduce the water costs associated with such protection. Although the proposed project and associated operations are still being developed, an initial project description is provided below. This description will be revised when further information becomes available.

The Two-Gate Project would involve the installation and operation of two gate systems in the central Delta: one on the Old River between Holland Tract and Bacon Island, and one on Connection Slough near Middle River between Bacon Island and Mandeville Island.

The project would be implemented in two phases. Phase 1 (a 5-year pilot period) would involve the installation and operation of temporary gates constructed from barge modules with top-mounted butterfly gates. This barge-gate system and temporary sheetpile walls connecting them to the river channel levees would be set in place seasonally from mid-December through June, and then removed until the following December. If operation of these gates proves successful during the pilot phase, Phase 2 would involve the installation and operation of an inflatable bladder gate system or equivalent system.

Both the Phase 1 and Phase 2 gate installations would be operated under protocols developed to protect delta smelt; this would include real-time monitoring elements to determine when to operate the gates, and an evaluation process to assess operational success. In effect, the Old River and Connection Slough gates would provide hydraulic separation of the Franks Tract area from the effects of reverse flows of Old River and Middle River and would be operated in a manner to allow vessel passage.

Compatibility between the Franks Tract Project and the Two-Gate Project will be considered as part of the Franks Tract federal planning process as both projects are further developed (USBR July 2009, 6-12).

### Suisun Management Plan (20)

The Bureau of Reclamation, USFWS, and DFG are currently NEPA and CEQA lead agencies in the development of a management plan to restore 5,000 to 7,000 acres of tidal wetlands and enhance existing seasonal wetlands in Suisun Marsh (USBR

July 2009). The plan would be implemented over 30 years and is expected to contribute to the recovery of many terrestrial and aquatic species. The EIS/EIR for the plan is expected to be complete in 2009 (USBR July 2009, 6-14).

### Delta Water Supply Project (DWSP) (21)

The City of Stockton Municipal Utility Department is constructing a new pipeline and treatment facility. The DWSP will develop a new supplemental water supply for the Stockton Metropolitan Area by taking in water from the Delta and pumping that water through miles of pipeline running along Eight Mile Road. From there, the water will be pumped to a state-of-the-art surface water treatment plant where it will be treated to drinking water standards. The water treatment plant will be located just north of Eight Mile Road on Lower Sacramento Road (City of Stockton, 2009). The Final EIR for the \$200 million project was completed in October 2005, construction began in 2009, and the expected completion date is 2011.

## 3. Longer-Term Future Delta Projects

### South Delta Improvement Program (SDIP) Stage 1 (22)

The SDIP is divided into Stages 1 and 2. Stage 1 includes the construction and operation of permanent operable gates (to replace the temporary barriers), dredging in portions of the south Delta, and extension of some agricultural diversion structures by 2012 (USBR July 2009). The operation of the gates is included in the OCAP analysis.

The head of Old River gate would be operated between April 15<sup>th</sup> and May 15<sup>th</sup> and in the fall. The remaining three agricultural gates would be operated April 15<sup>th</sup> through the agricultural season. The gates would maintain south Delta water levels

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above 0.0 mean sea level for channels upstream of the operable gates (USBR July 2009, 6-2).

The NOAA-Fisheries OCAP Biological Opinion specified that the DWR shall not implement Stage 1 of the SDIP because of concerns that microhabitats created at the permanent barriers would increase fish predation. The DWR is exploring different barrier designs and conducting monitoring on predation impacts at their South Delta Temporary Barriers. The DWR is likely to reinitiate consultation on the SDIP Stage 1 once that monitoring is completed (NOAA-Fisheries June 2009). The DWR will continue to pursue this project, although it is not likely to be implemented until 2016.

### Upper San Joaquin River Basin Storage Investigation (23)

The Upper San Joaquin River Basin Storage Investigation is a feasibility study by the U.S. Bureau of Reclamation and DWR (USBR July 2009). The purpose of the investigation is to determine the type and extent of federal, State, and regional interests in a potential project in the upper San Joaquin River watershed to expand water storage capacity; improve water supply reliability and flexibility of the water management system for agricultural, urban, and environmental uses; and enhance San Joaquin River water temperature and flow conditions to support anadromous fish restoration efforts.

Progress and results of the investigation are being documented in a series of interim reports that will culminate in a Feasibility Report and an EIS/EIR. The first of a series of reports analyzing alternatives was completed in 2003, with a second report, an “Initial Alternatives Information Report,” completed in spring 2005, and a Plan Formulation Report completed in October 2008. A final feasibility report and environmental review are expected to be complete in 2011 (USBR July 2009, 6-8).

### Tracy Fish Test Facility (24)

The Tracy Fish Test Facility, to be constructed near Byron, California, will develop and implement new fish collection, holding, transport, and release technology to significantly improve fish protection at the major water diversions in the south Delta (USBR July 2009). The DWR and USBR will use results of the Tracy Fish Test Facility to design the potential Clifton Court Forebay Fish Facility, and improve fish protection at the Jones Pumping Plant facility.

The test facility, unlike conventional fish screening facilities, will require fish screening, fish holding, and fish transport and stocking capabilities. The facility would be designed to screen about 500 cfs of water at an approach velocity of 0.2 feet per second and meet other appropriate fish agency criteria. The facility would have the structural and operational flexibility to optimize screening operations for multiple species in the south Delta.

Construction of the facility has been delayed by shortfalls in funding. The South Delta Fish Facilities Forum, a CALFED workgroup, is evaluating the cost effectiveness and cost sustainability of the fish facilities strategy. If eventually constructed, the Tracy Fish Test Facility would not affect current CVP and SWP operations (USBR July 2009, 6-9).

### Delta Cross Channel (DCC) Re-operation and Through-Delta Facility (25)

As part of the CALFED ROD, changes in the operation of the DCC and the potential for a Through-Delta Facility (TDF) are being evaluated (USBR July 2009). Studies are being conducted to determine how changing the operations of the DCC could benefit fish and water quality. This evaluation will help determine whether a screened through-Delta facility is needed to improve fisheries and avoid water quality disruptions. In conjunction with the DCC operations studies, feasibility studies

are being conducted to determine the effectiveness of a TDF. The TDF would include a screened diversion on the Sacramento River of up to 4,000 cfs and conveyance of that water into the Delta. Both a DCC re-operation and a TDF would change the flow patterns and water quality in the Delta, affecting fisheries, ecosystems, and water supply reliability. Further consideration of related actions will take place only after completion of several assessments (USBR July 2009, 6-10).

### Bay Area Water Quality and Reliability Program (26)

The Bay Area Water Quality and Reliability Program would encourage participating Bay Area partners, including Alameda County Water District, Alameda County Flood Control & Water Conservation District, Bay Area Water Users Association, Contra Costa Water District, East Bay Municipal Utility District, San Francisco, and the Santa Clara Valley Water District, to develop and coordinate regional exchange projects to improve water quality and supply reliability (USBR July 2009). This project would include the cooperation of these agencies in operating their water supplies for the benefit of the entire Bay Area region as well as the potential construction of interconnects between existing water supplies. This program is in the preliminary planning stages. No specific projects have been proposed and evaluated in detail (USBR July 2009, 6-11).

### North Bay Aqueduct Intake Project (27)

The North Bay Aqueduct Intake Project would construct a new intake for the North Bay Aqueduct to increase the flow in the aqueduct (USBR July 2009). It will involve the construction of pipeline corridors and connection points to the existing North Bay Aqueduct. Possible intake points are the Deep Water Ship Channel, Sutter/Elk Slough, Steamboat Slough, Miner Slough, and Main Stem Sacramento River. Environmental analysis is expected to begin in 2009 (USBR July 2009, 6-11).

### Sacramento Valley Water Management Agreement (Phase 8) (28)

The State Water Board has held proceedings regarding the responsibility for meeting the flow-related water quality standards in the Delta established by the Delta Water Quality Control Plan (D-1641) (USBR July 2009). The State Water Board hearings have focused on which users should provide this water, and Phase 8 focuses on the Sacramento Valley users. The Sacramento Valley Water Management Agreement (SVWMA) is an alternative to the State Water Board's Phase 8 proceedings. The SVWMA, entered into by DWR, Reclamation, Sacramento water users, and export water users, provides for a variety of local water management projects that will increase water supplies cumulatively. An environmental document is being prepared for the program (USBR July 2009, 6-14).

## 4. Terminated Delta Projects

Some of these terminated projects were implemented, while others were planned, but never initiated. We describe these projects here for informational purposes, in the event that they are reinitiated.

### South Delta Improvement Project Stage 2 (29)

As described above, the SDIP is divided into Stages 1 and 2 (USBR July 2009). Stage 2 consists of increasing the permitting diversion amount at Clifton Court Forebay (CCF) to 8,500 cfs. All of SDIP was evaluated in an EIS/EIR, finalized in 2006. DWR and Reclamation are currently preparing a supplemental document for Stage 1. Neither agency intends to pursue Stage 2 in the near future, but it is included in the cumulative analysis because it could be foreseeable if Delta conditions improve and DWR and/or Reclamation decide to pursue it (USBR July 2009, 6-8).

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### **Delta Mendota Canal Recirculation Project** 30

The DWR and the Bureau of Reclamation are preparing a Draft EIR/EIS, expected to be completed in late 2009, on this project to evaluate recirculation of Delta water pumped from the Jones Pumping plant (CVP), back through waterways into the San Joaquin River (USBR 2007). This would reduce salinity and maintain adequate flows in the river, reducing reliance on New Melones Reservoir water supplies. The USBR and DWR are studying the potential impacts of recirculation, an option that was recommended in the CALFED Record of Decision. This project may not be implemented.

### **In-Delta Storage Project** 31

In-Delta Storage would increase the reliability, operational flexibility, and water availability for south-of-Delta water users (USBR July 2009). An in-Delta storage location can capture peak flows through the Delta in the winter when the CVP and SWP systems do not have the capacity or ability to capture those flows. Water can then be released from the in-Delta reservoirs during periods of export demands, typically summer months. Storing water in the Delta provides the opportunity to change the timing of Delta exports and the ability to capture flows during periods of low impacts on fish. In May 2006, the DWR completed the “2006 Supplemental Report to 2004 Draft State Feasibility Study In-Delta Storage Project,” and recommended that further detailed study of the In-Delta Storage Project be suspended until a proposal is submitted by potential participants detailing their specific interests, needs, and objectives that support re-initiation (USBR July 2009, 6-7). The Delta Wetlands Project, described earlier, is a private in-Delta storage project that is closer to implementation.

### **Lower San Joaquin Flood Improvements** 32

The primary objective of this potential project is to “design and construct floodway improvements on the lower San Joaquin River and provide conveyance, flood control, and ecosystem benefits” (CALFED ROD in USBR July 2009). This potential project would construct setback levees in the South Delta Ecological Unit along the San Joaquin River between Mossdale and Stockton, and convert adjacent lands to overflow basins and nontidal wetlands or land designated for agricultural use. The levees are necessary for future urbanization and will be compatible with the Sacramento and San Joaquin River Basins comprehensive study. Progress has been indefinitely delayed with no scheduled date for completion. Nevertheless, if implemented, the potential project may also include the restoration of riparian and riverine aquatic habitat, increased riparian habitat, restrictions of and on dredging and sediment disposal, reduction of invasive plants, and protection and mitigation of effects on threatened or endangered species. This potential project could contribute to ecosystem improvements in the lower San Joaquin River (USBR July 2009, 6-9).

### **North Delta Flood Control Ecosystem Restoration Project** 33

The purpose of the North Delta Flood Control and Ecosystem Restoration Project is to implement flood control improvements in the northeast Delta in a manner that benefits aquatic and terrestrial habitats, species, and ecological processes (USBR July 2009). The North Delta project area includes the North and South Fork Mokelumne Rivers and adjacent channels downstream of I-5 and upstream of the San Joaquin River. Solution components being considered for flood control include bridge replacement, setback levees, dredging, island bypass systems, and island detention systems. The project

will include ecosystem restoration and science actions in this area, and improving and enhancing recreation opportunities. In support of the environmental review process, a Notice of Preparation/Notice of Intent (NOP/NOI) was prepared and public scoping was held in 2003. An EIR was prepared in 2008, but the project is not currently funded for implementation (USBR July 2009, 6-10).

### B. Assessment of Cumulative Impacts

There is widespread acknowledgement among California policymakers that the Delta is in crisis. As the Governor's Delta Vision Blue Ribbon Task Force stated, "ecosystems have eroded, levees have deteriorated, fish populations have collapsed, and our system of delivering water has become ever more precarious" (Isenberg et al. 2008). There are numerous efforts, at the federal, State, and local level, to improve conditions in the Delta. The WHCP operates within this context of a deteriorated Delta environment, and an active array of public programs seeking to reverse this deterioration.

**Table 7-1**, starting on page 7-16, compares the environmental resource areas for which the WHCP has potentially significant impacts, with those of 33 other Delta projects and programs. All of the identified programs are intended to improve conditions in the Delta, for sensitive species and habitats, agriculture, or water quality, or some combination of these areas. However, in creating these improved conditions, each program also has the potential to result in significant environmental impacts, at least temporarily. Most of these 33 other Delta programs identified in this Chapter have significantly greater scope, and scale, than the WHCP. The WHCP affects only a relatively small percentage of the total Delta, while many of these programs have, or will have, Delta-wide affects. Currently, several of these programs are still in the planning relatively and permitting phases. Only the EDCP is of a similar small scale to the WHCP.

The two environmental resource areas that are most likely to be affected by cumulative impacts of the WHCP, combined with these other Delta projects and programs, are biological resources, and hydrology and water quality. Several projects and programs identified in Table 7-1 are in the planning phase, and have not completed environmental impact reports. However, given the scope of these project efforts, it is reasonable to assume that impacts to biological resources are likely.

To the extent that any of these Delta projects create stress (of any kind) on special status species and habitats, this stress could be compounded by the combined impacts of each program. For example, while the potential impacts of the WHCP on special status fish may be limited, if special status fish are already impacted by other Delta projects, the cumulative impact on special status fish may be significant.

The WHCP will implement mitigation measures, as described in Chapter 3, to minimize WHCP impacts to biological resources. In addition, as these other projects and programs are implemented, they will also implement mitigation measures to minimize impacts on biological resources.

The potential for cumulative impacts to hydrology and water quality are similar to those of biological resources. The WHCP will potentially result in unavoidable, potentially unavoidable, or avoidable impacts to water quality. Several of these other Delta programs may also result in at least temporary impacts to water quality, that when combined with the WHCP impacts, would be cumulatively considerable. WHCP mitigation measures, as described in Chapter 5, will minimize the WHCP's contribution to water quality degradation in the Delta. These other Delta projects will also implement mitigation measures to minimize impacts to hydrology and water quality.

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For projects with construction-related impacts to biological resources, hydrology and water quality, or hazards and hazardous materials, the DBW will coordinate with the respective implementing agencies to avoid conducting WHCP treatments in locations where construction is taking place. This simple action will reduce or eliminate the potential for cumulative impacts during the construction phase of any Delta project.

The program with the greatest potential to result in cumulative impacts with the WHCP is the EDCP, due to the similar nature of the two programs, and the similar nature of their potential

impacts. However, the EDCP and WHCP utilize different herbicides, and do not conduct treatments in the same areas of the Delta during the same time periods. As a result, the likelihood of significant cumulative impacts is low. In addition, both programs implement mitigation measures to reduce their respective impacts.

**Table 7-2**, following Table 7-1, provides a summary of the potential cumulative impacts resulting from the WHCP. It is likely that these cumulative impacts, should they occur, will be reduced, to some extent, by mitigation measures implemented by the WHCP, and the other programs.



## 7. Cumulative Impacts Assessment

**Table 7-1**

**Comparison of Potential Impacts of the WHCP and Projects in the Delta**

Page 1 of 2

Project	Objective	Environmental Resource Area – Potential Cumulative Impacts					Potential for Benefits	Status (as of July 2009)
		Agriculture	Biological Resources	Hydrology and Water Quality	Hazards and Hazardous Materials	Utilities and Service Systems		
Water Hyacinth Control Program	Controlling growth and spread of water hyacinth in the Delta	X	X	X	X	X	Yes	Existing
1. <i>Egeria densa</i> Control Program	Controlling growth and spread of <i>Egeria densa</i> in the Delta	X	X	X	X	X	Yes	Existing
2. Central Valley Project and State Water Project	Water storage and delivery		X	X			Yes	Existing
3. Environmental Water Account	Protect fish; increase water supply reliability		X	X			Yes	Existing
4. South Delta Temporary Barriers Project	Benefit migrating salmon and benefit agricultural water users		X	X			Yes	Existing
5. USFWS BO – Reasonable and Prudent Alternative	Protection of delta smelt		X				Yes	Existing
6. NOAA-Fisheries BO – Reasonable and Prudent Alternative	Protection of salmon, steelhead, and green sturgeon		X				Yes	Existing
7. Old River and Rock Slough Water Quality Improvement Project	Minimize salinity and other constituents in CCWD drinking water			X			Yes	Existing
8. CalFed Levees Program	Improve Delta levees		X	X			Yes	Existing
9. CalFed Ecosystem Restoration Program (DRERIP)	Refine and develop new ecosystem restoration projects		X				Yes	Existing
10. Stockton East Water District Efficiency Enhancement Project	Increase drinking water supplies in Stockton area		X	X			Yes	Existing
11. CCWD Alternative Intake Project	Improve drinking water quality		X	X	X		Yes	Near Future
12. City of Sacramento Water Facilities Expansion Project	Increase sustainable capacity of Sacramento water treatment facilities		X	X			Yes	Near Future
13. Sacramento River and Stockton Deep Water Ship Channels	Maintenance dredging and long-term channel improvements		X	X			Yes	Near Future
14. Delta Wetlands Project	Divert and store Delta water and wetlands and wildlife habitat improvements		X	X			Yes	Near Future
15. San Joaquin River Agreement and Vernalis Adaptive Management Plan	Protect juvenile salmon		X				Yes	Near Future
16. San Joaquin River Restoration Program	Restore fish, maintain water supplies		X				Yes	Near Future
17. Bay Delta Conservation Plan	Recover sensitive species and habitats while maintaining water supplies		X	X			Yes	Near Future

**Table 7-1**

**Comparison of Potential Impacts of the WHCP and Projects in the Delta** *(continued)*

Project	Objective	Environmental Resource Area – Potential Cumulative Impacts					Potential for Benefits	Status (as of July 2009)
		Agriculture	Biological Resources	Hydrology and Water Quality	Hazards and Hazardous Materials	Utilities and Service Systems		
18. Franks Tract Project	Improve water quality and fisheries conditions in the Delta		X	X			Yes	Near Future
19. Two-Gate Project	Protect delta smelt from entrainment at the SWP and CVP facilities		X				Yes	Near Future
20. Suisun Management Plan	Restore and enhance tidal wetlands		X	X			Yes	Near Future
21. Delta Water Supply Project	Develop a new water supply for the Stockton area		X	X			Yes	Near Future
22. South Delta Improvement Program Stage 1	Benefit migrating salmon, benefit agricultural water users, and increase water deliveries		X	X			Yes	Longer-Term Future
23. Upper San Joaquin River Basin Storage Investigation	Determine interest in projects to expand water storage capacity and reliability		X	X			Yes	Longer-Term Future
24. Tracy Fish Test Facility	Develop and implement new procedures to improve fish protection at major water diversions		X				Yes	Longer-Term Future
25. Delta Cross Channel Re-operation and Through-Delta Facility	Determine how changing operations of the DCC would improve fisheries and avoid water quality disruptions		X	X			Yes	Longer-Term Future
26. Bay Area Water Quality and Reliability Program	Encourage regional agencies to develop and coordinate regional projects to improve water quality			X			Yes	Longer-Term Future
27. North Bay Aqueduct Intake Project	Construct a new intake for the North Bay Aqueduct		X	X			Yes	Longer-Term Future
28. Sacramento Valley Water Management Agreement (Phase 8)	Developing approaches to meet flow-related water quality standards in the Delta			X			Yes	Longer-Term Future
29. South Delta Improvement Program Stage 2	Increasing permitted diversion at Clifton Court Forebay		X	X			Yes	Terminated
30. Delta Mendota Canal Recirculation Project	Reduce salinity and maintain water flows		X	X			Yes	Terminated
31. In-Delta Storage Project	Increase the reliability, operational flexibility, and water availability for south-of-Delta water users		X	X			Yes	Terminated
32. Lower San Joaquin Flood Improvements	Design and construct floodway improvements on the Lower San Joaquin River		X	X			Yes	Terminated
33. North Delta Flood Control Ecosystem Restoration Project	Implement flood control improvements in the northeast Delta		X	X			Yes	Terminated

## 7. Cumulative Impacts Assessment

**Table 7-2**  
**Summary of Potential Cumulative Impacts Resulting from the WHCP**

Resource Area and Potential Impact	Cumulative Impact	Description
<b>II. Agricultural Resources</b>		
d) Adversely impact agricultural crops or agricultural operations, such as irrigation	[X]	The WHCP may result in adverse impacts to agricultural crops through herbicide overspray or herbicide toxicity. The WCHP may also result in clogging of irrigation pumps from plant fragments. The EDCP has the potential to result in the same adverse impacts to agricultural crops and irrigation pumps
<b>IV. Biological Resources</b>		
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS	[X]	The WCHP may result in adverse impacts to special status species present in treatment areas through herbicide overspray, herbicide toxicity, food web effects, dissolved oxygen levels, and/or treatment disturbances. There is a potential for these listed projects to result in temporary or permanent adverse effects to special status species
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFG or USFWS	[X]	The WHCP may result in adverse impacts to riparian or other sensitive habitats due to herbicide overspray, dissolved oxygen levels, treatment disturbances, and/or plant fragmentation. There is a potential for these listed projects to result in temporary or permanent adverse effects to riparian or other sensitive habitats
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means	[X]	The WHCP may result in adverse impacts to wetlands through herbicide overspray, dissolved oxygen levels, treatment disturbances, and/or plant fragmentation. There is a potential for these listed projects to result in temporary or permanent adverse effects to wetlands
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites	[X]	The WHCP may result in adverse impacts to migratory fish through herbicide toxicity, food web effects, dissolved oxygen levels, and/or treatment disturbances. There is a potential for these listed projects to result in temporary or permanent adverse effects to migratory fish
<b>VII. Hazards and Hazardous Materials</b>		
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials in the environment	[X]	The WHCP may result in exposure to hazardous materials due to accidental spills of herbicide. The EDCP may result in exposure to hazardous materials due to accidental spills of herbicide. During the construction phase, the CCWD Alternative Intake Project may result in exposure to hazardous materials due to accidental spills
<b>VIII. Hydrology and Water Quality</b>		
a) Violate any water quality standards or waste discharge requirements	[X]	The WHCP may result in violations of water quality standards due to chemical constituents, pesticides, toxicity, dissolved oxygen levels, floating material, and/or turbidity. There is a potential for these listed projects to result in temporary or permanent violations of water quality standards
f) Otherwise substantially degrade water quality	[X]	The WHCP may degrade water quality due to chemical constituents, pesticides, toxicity, dissolved oxygen levels, floating material, and/or turbidity. There is a potential of these listed projects to result in temporary or permanent degradation of water quality
g) Otherwise substantially degrade drinking water quality	[X]	The WHCP may result in degradation of drinking water quality through chemical constituents, pesticides, and/or toxicity. There is potential for these listed projects to result in temporary or permanent degradation of drinking water quality
<b>XVI. Utilities and Service Systems</b>		
h) Result in problems for local or regional water utility intake pumps	[X]	The WHCP may result in adverse impacts to utility service intake pumps from plant fragments. The EDCP has the same potential to result in adverse impacts to utility service intake pumps