# Chapter 4 Current Program Activities

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## Figures



## Photographs



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# Chapter 4 Current Program Activities

## Fish Passage Improvement at DWR

The Department of Water Resources has been implementing fish passage improvement projects and studies through its divisions and districts as well as through its Fish Passage Improvement Program (FPIP). DWR has contributed engineering feasibility and environmental documentation and permitting services to a number of projects in the state.

Figure 4-1 displays impediments to fish passage throughout the area of concern and highlights FPIP priority structures as of 2003[1]. Figure 4-2 displays inventoried structures in relation to critical habitat established for winter-run Chinook salmon, an important Level I criteria for project selection.

**Figure 4-1 Structures in waterways of the Fish Passage Improvement Program**

[1] In July 2003, the FPIP was moved from the Integrated Storage Investigations Program to the Ecosystem Restoration Program within the CALFED Bay-Delta Program. FPIP's geographic scope under ISI was much broader than under ERP. Consequently, some areas, such as the Bay Area, where FPIP initially prioritized projects, no longer fall within the scope of FPIP. Subsequent versions of the Bulletin will reflect the narrower geographic scope.

**Figure 4-2 Known structures in critical habitat for winter-run Chinook salmon**

### Fish Passage Improvement Program Projects

The FPIP has identified projects from various waterways to support, encompassing a minimum of 120 structures (Table 4-1). Some projects are under way with contributions, such as engineering design from other divisions within DWR and coordination from agencies such as the US Bureau of Reclamation (USBR) and California Department of Fish and Game (DFG). The FPIP has initiated or has taken the lead in coordinating other projects. The projects in Table 4-16 meet Level I and several Level II criteria and are identified by the CALFED Ecosystem Restoration Program (ERP) or by DFG or by the US Fish and Wildlife Service (USFWS) for remediation. The FPIP has identified some as new opportunities that support the goals of the CALFED ERP. They include dams, road crossings, culverts, pipelines, bridge aprons, mined channels, and gravel pits.

**Table 4-1 Priority projects of the Fish Passage Improvement Program that meet Level I and Level II criteria**

### Other DWR Divisions and Districts

Table 4-2 lists fish passage improvement projects conducted by other DWR divisions or districts through other sources of funding. All of the projects involve DWR in a variety of roles with public or private participants.

The following project descriptions are organized by DWR's district boundaries.

**Table 4-2 Fish Passage projects of other DWR divisions or districts.**

#### *Northern District*

Northern District is providing engineering planning and design services to several projects including Clough Dam on Mill Creek, Iron Canyon and Bear Hole on Big Chico Creek, and dams on Battle Creek as part of the Battle Creek Salmon and Steelhead Restoration Project. In addition, Northern District is providing project management and oversight for the Mill and Deer Creek Water Exchange programs.

#### *Central District*

Central District provided preliminary design for a fish screen at the Hallwood-Cordua Irrigation diversion just upstream of Daguerre Point Dam.

### *San Joaquin District*

San Joaquin District is providing environmental and engineering planning and design services to several projects including San Clemente Dam on the Carmel River, the Magneson Pond Isolation Project (completed in 1996), the Milburn/Hansen Restoration Project on the San Joaquin River, and the Ratzlaff, Stone, and Robinson sites of the Merced River Salmon Habitat Enhancement Project on the Merced River. District support also includes post-project monitoring, geomorphic studies, revegetation, and environmental compliance services.

### *Division of Environmental Services*

The Division of Environmental Services is evaluating fish passage at a seasonal check dam and road crossing in Putah Creek as part of its ongoing participation in floodplain studies and habitat enhancements in the Yolo Bypass; evaluating fish passage at Fremont Weir in the Yolo Bypass; developing a study at Lisbon Weir in the Yolo Bypass Toe Drain to collect fish passage data for a through-Delta facility proposed by CALFED; and addressing fish passage issues at Suisun Marsh Salinity Control Gates.

## Upper Sacramento River and Tributaries

The Upper Sacramento River tributaries include Battle Creek; Big Chico Creek, Butte Creek and the Sutter Bypass, Clear Creek, Cottonwood Creek, Deer Creek, Feather River, Mill Creek, and Yuba River (Figure 4-3).

**Figure 4-3 Fish Passage Improvement Program priority waterways and known structures of the Sacramento River and tributaries**

### Battle Creek—Shasta and Tehama Counties

The Battle Creek Salmon and Steelhead Restoration Project (Photo 4-1) will open 42 miles of prime salmon and steelhead habitat on the main stem and north and south forks of Battle Creek and its tributaries. The project will restore winter-run, spring-run, fall-run, and late-fall run Chinook salmon and steelhead in one of the most important anadromous fish spawning streams in the Sacramento Valley, while maintaining the resource for electricity for California customers (Table 4-3 for a list of structures). The project will (1) remove five dams (Wildcat Dam on North Fork Battle Creek, Coleman (Photo 4-2) and south diversion dams on South Fork Battle Creek, Lower Ripley Creek Diversion Dam on Ripley Creek, and Soap Creek Diversion Dam on Soap Creek); (2) install fish screens and enlarge ladders at three other diversion dams (Eagle Canyon, North Battle Creek Feeder, and Inskip diversion dams); and (3) reconfigure various tailrace and penstock bypasses to ensure the use of a hydroelectric project under all conditions while meeting various instream biological criteria.

**Photo 4-1 Battle Creek Salmon and Steelhead Restoration Project**

**Table 4-3 Structures on Battle Creek**

The project includes a substantial increase to minimum instream flow requirements established under the Federal Energy Regulatory Commission (FERC) license and set new flow-ramping rate criteria. In addition, where dams are being removed, PG&E is transferring its diversion water rights to the DFG to be dedicated for instream use.

**Photo 4-2 Battle Creek—Coleman Dam /**Friends of the River photo

Two funds also have been established. A $3 million Water Acquisition Fund established within USBR allows for the purchase of additional water over 10 years after the project is completed. It would be used if more water is

necessary to restore fishery resources. The fund can be used to buy permanent additional water rights or it can be used to buy additional water on a one-time basis, such as during a drought.

Also, a $3 million Adaptive Management Fund has been created from a Packard Foundation grant. USFWS and The Nature Conservancy will administer the grant. A team of representatives from government resource agencies and PG&E is formulating an Adaptive Management Plan that sets criteria and mechanisms to track the success of the project and allows for funds to modify the project to ensure its success over the life of the FERC license. The team using adaptive management will continue to evaluate and modify the project after construction. The project involves State and federal government resource agencies and PG&E. It is also coordinated through landowners, the Battle Creek Watershed Conservancy, and the Battle Creek Working Group, a multi-agency and private-sector group that includes State and federal agencies, PG&E, power interest groups, urban and agricultural water agency associations, and ocean and sport fishing interests. The final EIS/EIR for the project is to be completed in spring 2005. Construction is projected to begin in spring of 2006 with the hydropower facility modifications, the north fork screens and ladders, and the Wildcat Dam and canal removals. The South Fork Dam and canal are slated for removal starting in 2007. Total cost for dam removals, fish ladders and screens, and bypass tunnels is more than $22.5 million. The project is moving forward under an alternative FERC license amendment process specifically approved for it. It is a hybrid of the traditional license amendment process and the collaborative process FERC has established for license renewal applications.

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With funding from the Anadromous Fish Restoration Project (AFRP), the Battle Creek Watershed Conservancy contracted with Terraqua, Inc. to conduct an assessment of stream conditions and sediment sources in the Battle Creek watershed from 2001 through 2002. While conditions varied from site to site, average site conditions were deemed moderately favorable for salmonid production when the following four condition indices were considered: substrate, pool frequency, wood frequency, and four biological metrics (Ward and Moberg 2004). Although land-use activities such as timber harvest, roads, and livestock grazing have proven to be significant sources of sediment in other watersheds, there was little direct evidence that these activities played a significant role when explaining the variability of key stream condition indices at the watershed scale. Rather, the Terraqua study points to the January 1997 storm as providing a significant source of sediments (Ward and Moberg 2004). The study was also invaluable for documenting existing stream conditions and developing a baseline against which future conditions can be assessed. The study will also be used to identify and prioritize future treatment of sediment sources.

USFWS and USBR are planning additional fish passage improvement projects as part of the Coleman National Fish Hatchery (CNFH) re-evaluation, to integrate CNFH operations with the restoration of the Battle Creek watershed. Plans to improve the CNFH water-supply intakes identify several alternatives. The USFWS Anadromous Fish Restoration Program identified construction of a tailrace barrier downstream of PG&E's Coleman Powerhouse as a high priority. It said the tailrace falsely attracts adult salmon

and steelhead to an area that has very poor spawning habitat. Construction of a tailrace barrier has been linked to alternatives for CNFH water-supply intake changes. Preliminary designs for the barrier and intake modifications have been completed; and construction funding is being sought. In addition, USFWS has received a 1999 CALFED grant of $1,633,400 to modify the CNFH barrier weir so that it more effectively blocks fall-run and late-fall run Chinook passage past CNFH and to improve the upstream fish ladder in the barrier weir to meet the same criteria that will be applied to the improved hydropower facility ladders in Battle Creek. The upstream fish ladder in the CNFH barrier weir will play an important role in monitoring the success of the Battle Creek Salmon and Steelhead Restoration Project. It will allow returning salmon and steelhead to be counted and sampled for important demographic information such as run-timing, stock, size, and condition. Obtaining environmental compliance and permits began as Phase I of the project in June 2000. USBR prepared and released a supplemental EIS/EIR in late September 2004. They are hoping to finalize the environmental document and begin construction late summer or early fall of 2005.

## Iron Canyon and Bear Hole Fish Passage Project, Big Chico Creek—Butte County

The Iron Canyon and Bear Hole Fish Passage Project will improve fish passage for spring-run Chinook salmon and steelhead trout past natural barriers in Big Chico Creek. (Refer to Table 4-4 for details on the two structures on Big Chico Creek.) The two projects, Iron Canyon and Bear Hole, are in Upper Bidwell Park, on city of Chico property. Twice in the past, the DFG trapped and hauled fish upstream past the barriers when flow conditions prevented passage. Changes are being considered that would improve upstream passage for anadromous fish over a greater range of flow conditions. DWR is under contract to USFWS to conduct a preliminary engineering investigation of alternative solutions to fish passage at the two sites. A technical report summarizing findings of the investigation includes preliminary design drawings, geologic and environmental documentation, and cost estimates for construction of alternatives.

**Table 4-4 Structures on Big Chico Creek**

**Photo 4-3 Big Chico Creek—Iron Canyon's worn concrete and collapsed floor /**DWR photo

At Iron Canyon, a fish ladder with 17 small concrete weirs was built in the 1950s. The weirs were built to help fish ascend a 35-foot vertical climb through large boulders along a 270-foot horizontal stretch of creek. Numerous repairs have been made to the original weirs that are mostly founded on basalt boulders of various sizes. Concrete was poured between boulders in the floors to provide a sealed pool in some of the ladder sections. Some of these pool floors have collapsed or leaked over the years and have been repaired periodically (Photo 4-3). Numerous leaks occur along the base of pool walls at the contact points between concrete and basalt. A few concrete plugs (concrete bags and walls) have been added in the upper ladder section to seal leaking pools. Sections of the weirs and walls throughout the ladder have either partially blown out or are worn to expose rebar. The preliminary engineering investigation includes assessing the condition of the existing fish ladder and developing alternatives that include repairing the existing structures and constructing new structures. DWR Northern District recently completed a technical analysis on the Iron Canyon fish ladder and solutions are currently being addressed. Presently, DFG is continuing to

make repairs as needed until another resolution is made (Ward 2004 Jul 28 pers comm).

Bear Hole is about a mile downstream from Iron Canyon. A natural constriction in the channel through the main passage route makes it difficult for fish to pass upstream. Altered hydraulic conditions at this site have caused a large drop in water surface elevation, making passage difficult at low flows. DWR's preliminary engineering investigation will identify alternatives to improve upstream fish passage past the constriction in the creek.

Organizations and agencies involved in the project include DWR, DFG, the National Marine Fisheries Service (NMFS), USFWS, the Big Chico Creek Watershed Alliance, and the city of Chico. Under a $125,000 contract with USFWS, DWR completed its preliminary engineering investigation and technical analysis. The recommended solution is now being addressed in a grant proposal for a value-engineering analysis. Meanwhile, DFG continues to monitor and make repairs as needed until a long-term solution is implemented.

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One Mile Dam, managed by the city of Chico, creates a public swimming pool on Big Chico Creek during the summer. An AFRP was completed in 1997 allowing flows to bypass the pool during cleaning to prevent sediment and debris from interfering with downstream spawning gravels. During the winter, the Chico Park Department installs shorter flashboards allowing the use of the fish ladder.

Other projects under way or to be completed in the future include; relocating and screening the M&T Ranch diversion, replenishing spawning gravel, and repairing the Lindo Channel weir at the Five-Mile Diversion.

## Butte Creek, Lower Butte Creek, Sutter Bypass—Butte County

Extensive restoration of anadromous fisheries were performed in the Butte Creek watershed with the goals of enhancing fish passage, increasing natural salmon and steelhead production, and enhancing riparian habitat. Two project areas, Upper Butte Creek and Lower Butte Creek, have been the focus of fish passage improvement efforts over the past 10 years (Table 4-5 for a list of fish passage barriers). These projects have been carried out by the Butte Creek Watershed Conservancy, Butte Creek Watershed Project, Lower Butte Creek Project, the Nature Conservancy, Ducks Unlimited, California Waterfowl Association, private diversion and landowners, federal and State resource agencies charged with fishery restoration, local water districts and county commissions, private individuals, reclamation districts, and a state university foundation.

**Table 4-5 Structures on Butte Creek and Sutter Bypass—Butte County**

**Photo 4-4 Butte Creek—White Mallard Bottom Weir/** DFG Paul Ward photo

### *Upper Butte Creek Watershed Project*

Declines in anadromous fish populations in the Butte Creek watershed are attributed to inadequate instream flows, unscreened diversions, inadequate passage over diversion dams (Photo 4-4), entrainment and stranding of adult fish at agricultural return drains (outfalls), poor water quality, and poaching

(DFG 1993). Numerous diversion structures including dams, siphons, canals, and weirs have been addressed in various projects since 1991. To date, more than $21 million has been spent removing five dams (Western Canal Main, Western Canal East Channel, Point Four Diversion, McGowan Dam, and McPherrin Dam), installing or improving nine fish screens and ladders (including Parrott-Phelan Diversion, Durham Mutual Diversion, Adams Diversion, and Gorrill Diversion), acquiring 45 cfs of water for instream flows; installing 10 flow gaging stations; acquiring 146 acres of land; inventorying diversions; and performing 12 upper and lower watershed evaluations and 15 structure analyses. Appendix C has details for specific projects of the Upper Butte Creek Watershed Project (Photo 4-5).

**Appendix C**

**Photo 4-5 Upper Butte Creek Watershed Project Weir 1, Sutter Bypass /** DFG Paul Ward photo

### *Lower Butte Creek Project*

Lower Butte Creek encompasses Butte Sink and the Sutter Bypass. Butte Sink is largely composed of seasonally flooded wetlands and provides an important migratory pathway for Chinook salmon and steelhead that spawn in the upper reaches of Butte Creek. Butte Slough and Sutter Bypass are seasonal and permanent wetlands, agricultural lands, and managed waterfowl habitats. The canals, sloughs, and flooded lands here are also important migratory and nursery areas for salmon and steelhead.

A Jones and Stokes study on the Butte Sink recommended it should be a flow through system, rather than screening the whole system. Salmon studied in the sink have two to three times the growth rate as juveniles in the main stem of the Sacramento River (Zirkle 2004 Sep 9 pers comm).

The Butte Creek/Sanborn Slough Bifurcation Upgrade Project was partially completed in December 2000 at a cost of $2.1 million from the Sacramento National Wildlife Refuge Complex. Ten additional structures have been upgraded in Lower Butte Creek (Table 4-3). All of the Lower Butte Creek projects have been designed to improve fish passage while maintaining the viability of associated agricultural activities and managed wetlands.

**Photo 4-6 Lower Butte Creek Project East-West Weir—Sutter Bypass /** DFG Paul Ward photo

DWR conducted preliminary engineering investigations and developed concept designs during 2002 for fish ladders at Willow Slough and Weirs 1, 2, and 3 in the east side of Sutter Bypass. Those investigations are complete and the designs are ready. DWR Northern District also did the design and completed the initial study for the Parrott-Phalen and Durham Mutual Diversions. On the west side of Sutter Bypass, Montgomery-Watson completed preliminary engineering for improving fish passage past Weir 3, Weir 5, and East-West Weir; they have been rebuilt and are no longer a fish impediment problem. The cost of rehabilitating Weir 3 and constructing new fish screens at the diversion was around $320,000. The cost of the new fish ladder and screen at Weir 5 was about $1.4 million. The estimated cost of the East-West Weir rehabilitation was $900,000 (Photo 4-6). In addition, Guisti Weir now has a specialized pipe installed to provide low flow fish passage around the weir, the diversion has been closed off, and water has been purchased allowing for instream flow. The existing structure of Weir 1 was stabilized.

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## Saeltzer Dam Berm, Clear Creek—Shasta County

Saeltzer Dam was removed from Clear Creek in November 2000. A berm of cleaned spawning gravel was constructed downstream from the dam site to retain additional sediment. Armored with large rocks, it did not wash out as predicted with winter storms. This created a new barrier to spring-run salmon expected to migrate upstream in late winter.

The FPIP provided construction resources under the direction of USBR to quickly remove the armoring and disburse the berm in March 2001. The project cost $28,000 and was completed before spring-run migration began (Photo 4-7 and Photo 4-8).

**Photo 4-7 Clear Creek—Saeltzer Dam Berm (Shasta County) before removal of armored gravel berm /**DWR photo

**Photo 4-8 Clear Creek after removal of armored gravel berm /**DWR photo

The Lower Clear Creek Floodway Rehabilitation Project has completed two of three phases. Additional funds are being requested from CALFED for the final phase of construction. The project has rehabilitated the natural form and function of the 1.8 miles of channel and floodplain along Lower Clear Creek. Work to date includes the following:

- Restoration of the channel to historical meander and semi-braided morphology
- Improvement of gravel transport, storage, and routing by reconstruction a confined channel
- Reconstruction of the channel to encourage natural floodplain creation, migration, deposition, and inundation processes;
- Restoration of stream grade to reduce exposed clay hardpan by increasing gravel supply; and
- Reduction of salmonid stranding and mortality by filling gravel pits and creating well-drained floodplain surfaces.

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## Deer Creek—Tehama County

During the 1800s, Deer Creek was utilized as a resource for the development of grazing, timber, and agricultural activities. In the first 20 years of the 1900s, water diversions were installed in lower Deer Creek with the intent of diverting 100 percent of the annual flow for agricultural and related purposes. These diversions created hazards for anadromous fish attempting to migrate to the upper reaches of Deer Creek to spawning grounds. There are three major diversions in place on lower Deer Creek: (1) Stanford-Vina Ranch Diversion Dam (Photo 4-9), (2) Cone-Kimball Diversion Dam, and (3) Deer Creek Irrigation Company Dam. Additionally, there is a diversion canal located in the lower watershed.

**Photo 4-9 Deer Creek–Stanford-Vina Ranch Diversion Dam /**Photo

The AFRP, in coordination with many local, State, and federal agencies, is in the process of completing or has completed about 17 projects in the Deer Creek watershed.

In 1996 a project was put forth with the objectives to build cooperative stakeholder partnerships, to compile existing information related to resource management within the watershed, to identify actions to improve anadromous fish habitat and ecosystem function, and to identify other community-based watershed issues. As a result The Deer Creek Watershed Conservancy (DCWC) established the framework to coordinate projects and management policies within the Deer Creek watershed. Additionally, AFRP

set out to create educational programs with stakeholders and local schools to help ensure a sustained commitment to maintaining a healthy watershed; and to support ongoing educational opportunities with California State University, Chico, and University of California, Davis. A Watershed Condition Analysis Report was produced identifying limiting factors associated with spring-run and fall-run Chinook salmon and steelhead production.

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During the late 1990s, AFRP in association with DFG, USBR, USFWS, and the Los Molinos Mutual Water Company (LMMWC), installed real-time gages and thermographs. These gages help water managing agencies ensure proper water flow for anadromous fish passage. The gages are also utilized to verify surface water and groundwater purchases and exchanges. DWR, in partnership with DFG, and the Deer Creek Conservancy (DCC), completed a water quality assessment on Deer Creek. There were 12 sites on Deer Creek that were used for sampling. Measurements included temperature, dissolved oxygen, pH, turbidity, minerals, metals, nutrients, bacteria, and macroinvertebrates. The conclusion of this assessment is that there appears to be no identifiable water quality factor that would affect anadromous fish production in Deer Creek.

An ongoing effort has been made to protect and enhance riparian areas along the Deer Creek watershed. By the end of 2004, a total of 15,225 feet of fencing has been put in place with the purposes of allowing riparian vegetation succession and growth, and to prevent erosion and waste created from cattle grazing. This project, facilitated by AFRP, was done with the cooperation and agreement of local landowners.

## Mill Creek—Tehama County

In the early 20th century, three small diversion structures (Upper Dam, Clough Dam, and Ward Dam) were built on lower Mill Creek to divert agricultural water. Fish screens and fish ladders have been in place for many years at each structure and are operated and maintained by DFG.

**Photo 4-10 Mill Creek—Ward Dam (Tehama County)**

Five-foot-high Upper Dam (Photo 4-10) and 5-foot-high Ward Dam have sloping-downstream faces that fish can swim over when there are sufficient flows. In wet years, fish can navigate Mill Creek and reach spawning grounds. In dry years, however, so much water may be diverted from the creek that fish passage is impossible. Ward Dam was rebuilt in 1997 and DFG built a new modified pool and chute ladder. In 1997, winter floods significantly damaged Clough Dam.

**Table 4-6 Clough Dam, a barrier to fish passage on Mill Creek**

Working together, DWR, DFG, USBR, the owner of Clough Dam, the water rights holders, and the water users came up with a plan to remove Clough Dam while still providing water to users from an outlet structure built at the LMMWC diversion ditch north of the creek (Table 4-6). DWR was awarded a California Bay-Delta Authority contract through USBR to design and remove the remains of Clough Dam and construct an inverted siphon pipe 10 feet below Mill Creek to carry water diverted at the Upper Diversion Dam to water users. (The diverted water is siphoned under Mill Creek and into the existing diversion ditch.) DWR manages the CALFED contract for this project. Construction was originally slated to begin in December of 2000 but,

due to landowner concerns, it was pushed back 2 years. The dam was removed in 2002, and the project was completed on June 30, 2003.

Today, LMMWC and DFG lease 7 percent of the water rights from a water rights holder to augment instream flow downstream of Ward Dam. In addition, LMMWC, DFG, and DWR have a water exchange agreement for enhancing instream flow: DWR pumps water from two wells into LMMWC canals in exchange for water released by LMMWC. DFG can request pulse flows, and LMMWC, on a voluntary basis, will try to accommodate.

The Mill Creek Adaptive Management Enhancement Plan will provide a more stable, secure source of water for migrating spring-run and fall-run Chinook salmon in lower Mill Creek. The plan will increase flow in the lower creek to 50 cfs downstream of Ward Dam between April and June and to 25 cfs from October to November 15. These target flows are a starting point that will be used until the actual flows required for successful fish passage over the dams can be determined. The goal of the plan is to increase the number of naturally produced adult spring-run Chinook salmon in Mill Creek to 4,400 in order to meet the USFWS-AFRP target.

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Under the Plan, the Orange Cove Irrigation District will acquire 7.5 percent of the adjudicated Mill Creek flow that will be held in trust with LMMWC. The water will be dedicated to instream flow from 16 Oct through June under an adaptive management strategy. The water acquired during the rest of the year will be made available to LMMWC in exchange for pulse flows and reliable water in dry years. DFG will determine the most appropriate timing for pulse releases. OCID has also agreed to conduct studies to develop additional water supplies to enhance fish passage downstream of Ward Dam. This additional water will likely come from conservation practices or a conjunctive use program. In addition to enhancing instream flow downstream of Ward Dam, the plan provides for monitoring and research to analyze hydrologic and biological data to manage fish flows, improve fishery flow strategies, and identify biological triggers required for adaptive management on Mill Creek. The Plan will be implemented over three years and will cost $1.5 million. Funding has been obtained, however negotiations with landowners concerning the siphon have not yet been completed and the project has not yet been started.

## Daguerre Point Dam–Yuba River

The 24-foot-high Daguerre Point Dam was built in 1906 by the federal California Debris Commission and the State to prevent hydraulic mining debris generated in the Sierra Nevada from washing into the Feather and Sacramento rivers (Table 4-7). The dam was equipped with two fish ladders in 1937 that Chinook salmon and steelhead have difficulty, under certain flow conditions, locating and navigating. However, during normal water years, approximately 60 percent of the fall-run spawn upstream of Daguerre Point Dam. The US Army Corps of Engineers rebuilt the dam in 1964 following damage from the 1964 floods. The 60-acre-foot reservoir behind the dam is filled with coarse sediment to its crest and currently passes all sediment over the dam under high flows. The dam currently provides head for water diversion for three irrigation districts.

**Table 4-7 Daguerre Point Dam: a barrier to fish passage on Yuba River**

At issue are the upstream and downstream fish passage impacts of Daguerre Point Dam. Salmon and steelhead swimming upstream can be delayed or blocked by debris in the fish ladders or by the dam under certain conditions, including high-river flows. Juvenile fish migrating downstream may be preyed upon at the base of the dam or may be injured or killed going over the dam. Some are concerned that if the dam is removed, predatory fish now blocked by Daguerre Point Dam would be able to swim upstream to primary salmon and steelhead rearing grounds. There are also concerns about contaminated sediment behind the dam and the current function and value of Daguerre Point Dam in controlling sediment transport downstream as it was originally intended.

The Lower Yuba River Technical Working Group, including the US Army Corps of Engineers (USACE), Yuba County Water Agency, DFG, DWR, NMFS, USFWS, South Yuba River Citizens League, Friends of the River, and other parties, was convened in 1998. The parties of the technical working group agree that more information is needed to evaluate fish passage improvement options at Daguerre Point Dam (Photo 4-11). Stakeholders and partner agencies are developing, conducting, and coordinating additional studies to examine the dam's impacts on fish and to develop a restoration prioritization plan to understand and implement other opportunities to improve habitat conditions in the lower Yuba River. Beginning in 1996, USFWS had funded the USACE through the AFRP, to study fish passage improvement options at Daguerre Point Dam. This study was completed in August 2001 (US Army Corps of Engineers 2001) and reviewed the possible costs and impacts of preliminary alternatives. A total of eight alternatives were reviewed, and four of those were eliminated from further evaluation. Those eliminated included (1) modifying existing ladders, (2) constructing a natural bypass channel around the dam, (3) installing an inflatable bladder dam, and (4) constructing a trap and truck fish facility. The alternatives selected for further analysis were no action, constructing new fish ladders, modifying the face of the dam by developing a cascading dam face, or removing the dam.

DWR and USACE have each agreed to take part in the completion of the necessary environmental studies through support of DWR's FPIP. Consultants have been hired by DWR to assist the agencies and stakeholders in developing some of the previously identified alternatives or new alternatives that were dropped in the preliminary studies by USACE in 2001. The contractors, DWR, and USACE are preparing an EIR/EIS that will identify preferred alternatives to improve anadromous fish passage at the dam. The contractors under guidance from the technical working group and the lead agencies will conduct additional studies to examine the dam's impacts on fish for analysis of alternatives to improve fish passage. The completion date of the EIR/EIS depends on ongoing negotiations between DWR and USACE regarding USACE's status as being the lead agency for finalization of the NEPA work. As part of the work, DFG and the US Geological Survey will study the sediments behind the dam to resolve environmental concerns over mercury contamination.

**Photo 4-11 Yuba River—Daguerre Point Dam**

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## Harry L. Englebright Dam-Yuba River

Harry L. Englebright Dam is in the Sierra foothills 21 miles east of Marysville on State Highway 20 (Table 4-8). Construction of the dam began in 1938 and was completed in 1941 at a cost of $4 million. Englebright Dam was built primarily to prevent upstream hydraulic mining debris from moving downstream into the Yuba River floodplain (Photo 4-12). The dam is a concrete constant angle arch dam, 260 feet tall and 1,142 feet in length. It impounds Englebright Lake, which is approximately 227 feet deep at the dam, covers 815 surface acres, is 9 miles long, and has 24 miles of shoreline.

Englebright Dam blocks migration of Chinook salmon and steelhead. The Upper Yuba River may present an opportunity for the CALFED process to improve habitat for native species whose populations are in decline, while developing a comprehensive plan that will restore ecological health, improve water management and provide positive benefits to the public. If restoration and introduction are feasible, stretches of the Upper Yuba River could provide a significant amount of habitat to help salmon and steelhead populations flourish and avoid implications of the Endangered Species Act.

In 1998, the CALFED ERP recommended a study program to determine if returning steelhead trout and spring-run salmon to the Yuba River was feasible. One of the CALFED ERP restoration goals is to improve habitats to support native plant and animal species. In 1999 the Upper Yuba River Studies Program was started to determine if the introduction of wild Chinook salmon and steelhead trout to the Upper Yuba River watershed is biologically, environmentally, and socio-economically feasible over the long term. The primary study area for this program includes the South Yuba River and its tributaries downstream of Lake Spaulding, the Middle Yuba River and its tributaries downstream of Milton Reservoir, and the North Yuba River and its tributaries downstream of New Bullards Bar Reservoir. Those participating in the program's Upper Yuba River Work Group include federal and State agencies, county supervisors, water and irrigation districts, commercial fishing organizations, sport fishing organizations, local and national environmental organizations, recreational and business organizations, flood control committees, county governments, and PG&E.

The program has three phases. In Phase 1 stakeholder work groups developed a list of study recommendations from which technical experts will develop feasibility study scopes of work.

The work group identified the following critical issue areas for study: (1) condition of upstream and downstream habitat for Chinook salmon and steelhead; (2) flood risk management; (3) economics; (4) sediment control; (5) water quality; and (6) water supply and hydropower effects.

In Phase 2 feasibility studies are being conducted for priority issues identified by the work group. In October 2003 the "Summary of Current Conditions in the Yuba River Watershed" was released by the Upper Yuba River Studies Program study team. This is an interim report, and most of the conclusions are preliminary. Studies are being continued in order to best answer the critical issue areas of study prior to moving on to Phase 3.

**Table 4-8 Englebright Dam, a barrier to fish passage on Yuba River**

**Photo 4-12 Yuba River–Harry L. Englebright Dam /** CALFED photo

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In Phase 3 the results of analyses will be evaluated and the combined stakeholder group will make recommendations on future steps.

## Lower Sacramento River and Delta Tributaries

Lower Sacramento River and Delta tributaries include Cosumnes River, Dry Creek, Murphy Creek, and Lower Putah Creek (Figure 4-4).

**Figure 4-4 Fish Passage Improvement Program priority waterways and known structures of the Lower Sacramento River and tributaries**

### Cosumnes River—Sacramento County

Five migration barriers (Ometto low-flow crossing, Mahon Flashboard Dam, Hop Ranch Dam, Blodgett Dam, and Granlees Diversion Dam) impede migration to suitable spawning areas of the Cosumnes River. Hop Ranch Dam, damaged in 1997 floods, and the road crossing are barriers to upstream migration that delay migrating fish in normal to low-flow years (Table 4-9). This sometimes resulted in no fall-run salmon spawning in the river.

**Table 4-9 Structures on the Cosumnes River—Sacramento County**

Blodgett Dam, owned by the Omochumne-Hartnell Water District (OHWD), was damaged by 1997 floods and was inoperable (Photo 4-13). Approximately 200 fall-run salmon were stranded downstream of Blodgett Dam in fall 1998. Flows at the time were 70 cfs. Flows above about 150 cfs are required for this structure to effectively pass fish. A fish bypass channel was excavated around the dam, resulting in stream channel erosion. The district rebuilt the dam, including channel improvements and fish passage in the new design, in fall 2002 with funds from the Federal Emergency Management Agency. The FPIP participated with DFG and the district in planning fish passage improvement at the dam. DWR withdrew from participation when questions arose concerning the district's legal water rights in conjunction with their proposed uses of the water to be stored behind the dam. The California Fishery Foundation, in partnership with OHWD repaired and reinforced the dam, added boulder weirs and flow focusing curves in 2003.

**Photo 4-13 Cosumnes River—Blodgett Dam after flood damage /**DFG Photo

Rancho Murieta Community Service District operates the 17-foot-high Granlees Diversion Dam (Photo 4-14). The dam has two fish ladders, which are functional between a narrow range of flows (Photo 4-15). However, the ladders were both more than 70 years old, in need of repair, and filled with coarse sediment. An informal inspection by DFG in 1998 suggested the following deficiencies:

- Excessive jump heights in all pools
- Inadequate dimensions in resting pools
- Substandard entrance pool for wide range of flows
- High risk of salmon spilling back into the basin after exiting the ladders due to poorly placed spillway
- Inadequate wall height increasing the risk of larger fish jumping out of resting pools
- Misleading attraction flows on opposite side of the basin

**Photo 4-14 Cosumnes River—South Granlees Diversion Dam (Sacramento County)/**DWR photo

The minimum flow needed for effective passage at Granlees Dam fish ladders is about 150 cfs.

**Photo 4-15 Cosumnes River—fish ladder at North Granlees Dam (Retrofited in 2003)/**DFG photo

Solutions to these problems had been actively pursued since 1999. As a result, the Fishery Foundation obtained $376,510 in CALFED and AFRP funding for the Cosumnes River Salmonid Barrier Improvement Project. The modification of the fish ladders at Granlees Diversion Dam was completed in 2003. The project constructed the ladders to current hydraulic criteria for fish passage and significantly increased their durability so they can withstand a wide range of hydrologic conditions. The ladders are designed to pass fish over a wide range of flows so that the occurrence of stranding will be reduced during low flow periods.

Hopland Dam and the road crossing were retrofitted with low-flow passage structures to allow for fish passage over a greater range of flows. Retrofitting of the road crossing included adding a 6-inch deep low-flow barrier with two 10-foot openings to focus flows. The project was completed in 2000, and fall-run Chinook salmon were observed successfully passing through the new crossing structure during the fall 2000 migration. These projects and others listed in the Table 4-7 have eliminated five barriers to fish passage on the Cosumnes River and mark the beginning of the recovery of sustained runs of fall-run Chinook in the watershed. Post-project monitoring will be conducted for three years to compare run timing, migration delays, and spawner success to pre-project levels.

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## Dry Creek—Sacramento and Placer Counties

Two dams and two pipeline crossings impede fall-run Chinook salmon and Central Valley steelhead migrating to upstream tributaries of Dry Creek that have excellent spawning habitat. In summer 2004, the 9-foot-high Hayer Dam in Rio Linda was removed along with diversion facilities in Lower Dry Creek. Sacramento Area Flood Control Agency (SAFCA) and other local partners removed the Hayer Dam using DWR Flood Protection Corridor Funds (Photo 4-16). DWR FPIP personnel served on the technical advisory committee for the project. A rock weir with fish passage channel was used to replace the dam structure while minimizing upstream movement of accumulated sediments. In 2005 a buried infiltration gallery will be constructed at the site to allow continued water diversion to the Bell Aqua lakes. Built in the 1930s for irrigation, Hayer Dam was owned by Sacramento County and provided water to a private water ski lake, Bell Aqua.

**Photo 4-16 Dry Creek—Hayer Dam /**DWR photo

In addition, there is a 4-foot-high concrete-block rubble dam and the 20-foot-high Cottonwood Dam upstream. Cottonwood Dam, situated in the Hidden Valley residential subdivision on Miners Ravine, creates an impassable barrier. The water pipeline was abandoned by the city of Roseville and crosses the mouth of Secret Ravine (Photo 4-17). A sewer pipeline across Dry Creek also poses passage problems at low flows. Recently, DFG has stipulated the season of operation for the rubble dam to allow salmon and steelhead to pass during spawning season. See Table 4-10 for a listing of structures in the Dry Creek watershed.

**Photo 4-17 Dry Creek—pipeline on Secret Ravine (Sacramento and Placer counties)/**DWR photo

**Table 4-10 Structures in the Dry Creek watershed—Sacramento and Placer counties**

Restoration and fish passage activities are coordinated by the Dry Creek Coordinated Resource Management Plan group. DWR participates in the Dry Creek CRMP and coordinates fish passage improvements at various structures. The CRMP is composed of city and county government, local

flood control and park districts, local schools and colleges, fishing and conservation organizations, and State and federal resources agencies. Placer County and the DCC have each received grants to restore various habitats along Dry Creek. The Central Valley Project Improvement Act AFRP granted funds to inventory conditions on Secret Ravine and to assist locally led efforts to develop a watershed management plan. A $605,000 grant was awarded to Placer County to carry out CRMP objectives. The grant is intended to improve water quality and includes funding for a watershed management plan, water quality monitoring, and a demonstration restoration project on Miners Ravine. The plan also includes a strong public education component. In addition, both the city of Roseville and the DCC were successful in obtaining new CALFED grants in 2001 for development of a creek and riparian management and riparian restoration plan. In 2002, the city of Roseville also received a DWR Urban Stream Restoration grant to address erosion issues on Dry Creek in the vicinity of the city's sewer pipeline. The city has agreed to allocate some of the grant funds for fish passage improvement at the sewer pipeline along with the erosion control work scheduled in 2003. In addition, the city of Roseville has requested engineering and environmental permitting assistance from DWR for the removal of the abandoned water pipeline on Secret Ravine. The Hidden Valley Homeowners Association requested assistance with fish passage at Cottonwood Dam. As a first step, DWR completed a barrier inventory and stream habitat quality survey upstream and downstream of Cottonwood Dam to help determine whether any benefits for salmonids could be gained by providing access to upstream reaches.

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## Murphy Creek—Amador and San Joaquin Counties

Murphy Creek is a tributary of the Mokelumne River that traverses Amador and San Joaquin counties, entering the Mokelumne River immediately downstream of Camanche Reservoir. Adult salmon and steelhead historically used the creek and were rarely seen in the lower portions. Two structures impeded fish migration—Sparrowk Dam and Buena Vista Road bridge double box culverts (Table 4-11). Sparrowk Dam historically provided water for livestock grazing (Photo 4-18).

**Table 4-11 Structures on Murphy Creek—Amador and San Joaquin counties**

The landowners adjoining Murphy Creek in San Joaquin County initiated a project to improve fish passage; restore rearing and spawning habitat for Chinook salmon and steelhead; restore native riparian vegetation to encourage the re-establishment of neotropical migratory birds and other special status wildlife species; improve water quality and improve water flows within the creek; and promote sustainable agricultural practices that continue to support livestock and vineyard production within the watershed

**Photo 4-18 Murphy Creek–Sparrowk Dam with concrete spillway in foreground, dam in background (Amador and San Joaquin counties)/**DWR photo

East Bay Municipal Utility District was the lead agency on this project and prepared a Mitigated Negative Declaration pursuant to CEQA for the project. EBMUD worked closely with the participating landowners to ensure that they retained their water rights and at the same time be able to enhance the riparian and aquatic habitat within the watershed. DWR's FPIP provided topographical surveys, archaeological surveys, and preliminary engineering design work. EBMUD completed the project in August 2003.

The project removed Sparrowk Dam, its spillway, and the accumulated sediment from the reservoir. It was also funded by grants from the CALFED Bay-Delta Program, $282,500; the National Fish and Wildlife Foundation, $95,000; USFWS-AFRP, $10,000, and in-kind services from EBMUD, $115,000; and DWR FPIP, $100,000.

A well was dug near the existing impoundment to provide water to a new stock-watering tank. In addition, the Buena Vista Road bridge double box culverts were modified to improve fish passage during low-flow periods.

Cooperating agencies, organizations, and others include Murphy Creek Landowners, Bev and Jack Sparrowk, EBMUD, San Joaquin County Resource Conservation District, University of California, Davis, USDA Natural Resource Conservation Service, DFG, DWR, NMFS, and USFWS.

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## Lower Putah Creek—Yolo County

The Lower Putah Creek Anadromous FPIP will assess the degree to which four structures on the lower 24 miles of Putah Creek impede anadromous fish passage (Table 4-12). The structures are:

- the 12-foot-high seasonal check dam in the Yolo Bypass used to create a head of water for irrigation pumping and to flood the Vic Fazio Yolo Wildlife Area,
- culverts under a seasonal road about RM 1.5,
- the concrete remnants of the base of a dam a quarter mile downstream of a former railroad crossing at the city of Winters, and
- the Putah Diversion Dam about RM 23.

**Table 4-12 Structures on Lower Putah Creek—Yolo County**

**Photo 4-19 Lower Putah Creek—check dam (Yolo County)/**Joe Krovoza photo

The fledgling program under the auspices of the Lower Putah Creek Coordinating Committee (LPCCC) will oversee solutions to eliminate the barriers by modifying structures or managing them differently. There are already informal protocols for the operation of the seasonal check dam in the Yolo Bypass, requiring removal in the fall to allow salmon and steelhead passage (Photo 4-19). Addressing the Yolo Bypass check dam is a high priority of the program. How this structure should be managed or modified is being considered.

Those working on the Yolo Bypass check dam include Solano County Water Agency, Putah Creek Council, Los Rios Farms, University of California, Davis, fisheries researchers, DWR, DFG, and the Yolo Basin Foundation. The LPCCC is composed of 10 representatives from Yolo and Solano counties. The group will manage instream and riparian habitat restoration projects on more than 30 miles of Lower Putah Creek from Monticello Dam to the Yolo Bypass. The cost of the project will depend on an initial assessment of passage barriers and the approved plans for modification or management of each barrier. Preliminary evaluations of the check dam and road crossing were done in 2001 under a CALFED ecosystem restoration grant and DWR funds totaling $820,679. No specific projects have yet been proposed, nor is there a timeline or budget for fish passage improvements at the check dam, road culvert, Putah Diversion Dam, or percolation dam remnants.

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Those interested in Putah Creek are in a position to begin addressing barriers to anadromous fish passage. In May 2000, a Putah Creek accord was signed that ended a 10-year water rights dispute. Now there are permanent flows in Lower Putah Creek specifically designed to benefit the creek's assemblage of native fish. Importantly, the creek now has a set of supplemental flows designed to attract the native anadromous fish of Putah Creek (namely fall-run Chinook salmon, steelhead trout and Pacific lamprey). The water rights accord set the stage for everyone to address the anadromous fish barrier issues.

## Fremont Weir, Yolo Bypass—Yolo County

Fremont Weir (Table 4-13) is at the northern end of the 40-mile -long Yolo Bypass (Photo 4-20). The Yolo Bypass is a 59,000-acre leveed basin that functions as a floodplain and conveys excess flows from the Sacramento River, Feather River, American River, Sutter Bypass, and other streams originating from the western drainages of the Sacramento Valley into the Sacramento-San Joaquin Delta. Under typical flood events, water spills into Yolo Bypass via the 1.8-mile-long Fremont Weir when Sacramento basin flows surpass approximately 56,000 cfs. Field and anecdotal evidence show that adult salmon migrate up the Yolo Bypass through the toe drain, the eastern edge channel and riparian corridor, in autumn and winter regardless of whether Fremont Weir spills.

**Table 4-13 Structure on the Yolo Bypass—Yolo County**

**Photo 4-20 Yolo Bypass—Fremont Weir (Yolo County)**

Although there is a single, small fish ladder at the center of the weir, the ladder seldom operates. Stop-logs keep the ladder closed except during the descending limb of floods that overtop Fremont Weir. When waters recede below the crest of Fremont Weir, DFG staff will remove the boards to allow the ladder to flow, in accordance with ladder permitting terms.

Sturgeon and salmon are commonly attracted by high flows into the Yolo Bypass basin, north to Fremont Weir. After the fish ladder is open, some of the salmon concentrated behind Fremont Weir pass through the ladder into the Sacramento River. Sturgeon trapped downstream are unable to utilize the small Denil ladder. DFG wardens are well aware of the heavy fishing pressure in the vicinity of Fremont Weir, and DFG commonly rescues the more accessible sturgeon and salmon downstream of Fremont Weir by netting and hauling them by hand or truck to the Sacramento River.

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At low flows, no fish could pass even if the existing ladder were open because it is perched above Sacramento River stages associated with nonflood conditions.

In 2000 DWR's FPIP conducted elevation surveys of the area downstream of the weir as a preliminary step for a pilot fish passage facility and evaluation study for CALFED. DWR staff has been studying fish in the Yolo Bypass since 1997. Beginning in early 2000, DWR's Division of Environmental Services has conducted additional evaluations to examine ways to improve fish passage. As part of this effort, staff continues to participate in the Yolo Bypass Working Group, a forum for discussing issues and concerns in the Yolo Bypass. The group includes Yolo Bypass farmers, landowners, duck clubs, environmental groups, and several regulatory agencies.

## Through-Delta Facility Experimental Study Structure, Yolo Bypass—Yolo County

CALFED has determined that a through-Delta facility, a 4,000 cfs diversion, could be an integral part to meeting two of its mandates: improving water supply and quality and protecting the Delta ecosystem. According to the CALFED Record of Decision, water quality, fish effects studies, and the development of project recommendations must be completed by the end of 2003. If a through-Delta facility is built, upstream fish passage around a fish screen, radial gate, or pumping plant structure will be a major design consideration.

In coordination with the interagency North Delta Fish Facilities Technical Team, DWR Division of Environmental Services developed an experimental fish passage structure in the Yolo Bypass Toe Drain. It is sometimes referred to as a portable resistance board weir, or an Alaskan Fish Weir. A Didson camera will monitor the timing and conditions when fish pass will be monitored by a Didson camera and by fish tagging to collect data for the development of the proposed through-Delta facility.

This study will provide information to help evaluate the feasibility of constructing a fish facility for the through-Delta facility for upstream passage of salmon, sturgeon, splittail and striped bass. The Yolo Bypass Toe Drain has many of the fish species that will be of concern at a through-Delta facility. DWR and DFG staffs have been conducting fish studies in the Yolo Bypass for several years. Field and anecdotal evidence show that adult salmon migrate up through the toe drain/tule canal in autumn and winter. High flow events in particular attract numerous upstream migrants through the Yolo Bypass corridor.

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## Lisbon Weir Yolo Bypass—Yolo County

Lisbon Weir is a constructed impoundment structure that raises the water surface elevation upstream of it to form a pool for upstream irrigators. The weir is comprised of a sheetpile wall driven into the bottom of the toe drain channel and large concrete blocks, both covered by a broad layer of riprap (Photo 4-21). In an open-side channel that flows around the weir on its west side, three flap gates allow tidal water to flow in the upstream direction but do not allow the water to flow back downstream. Tidal flow through these one-way flap gates, as well as flow over the top of the riprapped section of the weir during high tides, recharges the pool with irrigation water upstream. During the summer, net flow past Lisbon weir is negative; an average of approximately 50 cfs flows upstream (north).

**Photo 4-21 Yolo Bypass toe drain—Lisbon Weir /**DWR photo

Planned study activities include (1) capturing, telemetry tagging, and releasing fish one mile downstream, (2) examining the behavior of the tagged fish near Lisbon Weir as they migrate upstream, and (3) determining the conditions under which these fish move past the weir with minimal delay. One of the variables that will be examined is the effectiveness of holding the side channel gates open when the irrigation season ends in order to facilitate sturgeon passage past Lisbon Weir.

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# San Joaquin River and Tributaries

San Joaquin River tributaries include the Calaveras River, Merced River, Stanislaus River, and Tuolumne River (Figure 4-5).

## Calaveras River—Calaveras County

There is spawning and rearing habitat for salmonids between Bellota Weir and New Hogan Dam (USFWS 2000a). Twenty-eight unscreened diversions exist between Bellota and New Hogan Dam within the service areas of the Stockton East Water District (SEWD) and Calaveras County Water District. Some diversions are in spawning and rearing habitat for fall-run Chinook salmon. The largest diversion is Bellota Weir, which regulates water between the historical Calaveras River channel, Mormon Slough, the main flood control channel, and the intake for SEWD's water treatment plant.

**Figure 4-5 Fish Passage Improvement Program priority waterways and known structures of the San Joaquin River and tributaries**

Water is diverted at Bellota for the 45-million gallon-per-day SEWD water treatment plant that supplies treated water to the Stockton urban area. The water treatment plant had a DFG fish screen that was inoperable at flows higher than 250-million gallons per day, and it was subsequently removed. Through a CALFED grant, SEWD has contracted with CH2MHill to design an alternative diversion to replace Bellota Weir with a rubber dam and permanent fish ladder. The design includes the placement of a fish screen. SEWD, along with the California Fishery Foundation and their biological consultants are also engaged in investigations to determine the distribution, timing, and abundance of salmonids in the Calaveras system. Information gathered will be used to develop appropriate fish protection and migration corridors, including the using the Old Calaveras River section during lower winter flows. SEWD now uses the old channel for groundwater recharge but is using procedures to reduce opportunities to trap migrating fish when water levels drop. In order to meet CALFED requirements, SEWD is also contracting with S.P. Cramer & Associates to develop a monitoring and evaluation plan. Information and data gathered from DWR, CH2MHill, the Fishery Foundation, AFRP, and S.P. Cramer & Associates will help SEWD work towards implementing a project.

In 1990, Calaveras County Water District provided fish protection at its water treatment plant diversion facility downstream of New Hogan Dam. In addition, numerous unscreened agricultural diversions associated with installation of seasonal flashboard dams exist in Mormon Slough, Potter Creek, and Mosher Creek (Photo 4-22). In dry or drought years, some of these waterways can dry up by the end of June. During the irrigation season, most water is diverted at Bellota Weir into Mormon Slough leaving the historical Calaveras River Channel dry.

**Photo 4-22 Mormon Slough—flashboard dam /**DWR photo

In 1998, the Central Valley Steelhead ESU was listed as threatened by NMFS, and in February 2000, NMFS designated the Calaveras River and Mormon Slough as critical habitat for the Central Valley steelhead ESU.

In 1999, the SEWD and the Calaveras County Water District received a grant from the State Water Resources Control Board to implement the Calaveras River Watershed Study and have retained a consultant to conduct fish

surveys and collect habitat and temperature data for the Calaveras River. The water districts are also involved in consultation with State and federal regulatory agencies to discuss operational changes at New Hogan Dam. A partial listing of structures is found in Table 4-14.

**Table 4-14 Structures on the Calaveras River, Mormon Slough, and the Stockton Diverting Canal**

Three studies are being conducted in the Calaveras River to improve fish passage and determine Chinook salmon and steelhead distribution and life history in the river. All three are benefiting from cooperative coordination. SEWD and the Calaveras County Water District have received preliminary approval for a $670,000 CALFED Ecosystem Restoration Grant for Phases I and II of a fish screening project for diversions between Bellota and New Hogan Dam. Phase I is a feasibility study, including a reconnaissance-level study of the Calaveras River, preliminary designs for fish screens, fisheries monitoring, and a draft data collection and monitoring program. Phase II includes preliminary engineering designs for screening alternatives at the SEWD Bellota diversion (Photo 4-23), stakeholder meetings, prioritization of diversions for screening, and possible plans to consolidate diversions. CEQA and NEPA processes will be initiated during this phase. In Phase III a final design will be approved, and permitting and environmental documentation processes will be completed. Construction and monitoring will be implemented as part of Phase IV. Additional funding will be required to complete Phases III and IV.

**Photo 4-23 Mormon Slough—Bellota Weir with temporary fish ladder /**DWR photo

The Fishery Foundation received a $314,704 AFRP grant to conduct the Lower Calaveras River Chinook Salmon and Steelhead Population Abundance and Limiting Factors Analysis. The 2-year study will be coordinated with a stakeholders group, and it will provide quantitative information upon which future restoration actions can be developed. The first year of field data collection was completed in 2002.

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Through a CALFED grant, SEWD is contracting with CH2MHill to design a year round fish screen at Bellota and a rubber dam with a permanent fish ladder to replace Bellota Weir (contracted through preliminary design only). There are also plans to open up the Old Calaveras River section during lower winter flow periods.

In addition, the DWR FPIP is conducting a barrier inventory and evaluation on the Calaveras River from its confluence with the San Joaquin River to New Hogan Dam, including Mormon Slough and other primary channels. The inventory is ongoing. A preliminary report evaluating fish passage along the current migratory pathway is under development. The results of the study will be used in conjunction with salmon and steelhead life history data to identify and prioritize potential fish passage improvement projects.

## Merced River—Merced County

The Merced River abandoned its river channel and captured gravel pits in several reaches in the early 1980s and after a January 1997 flood (Table 4-15). In these reaches the river traveled through wide areas, where characteristics varied from flat areas with an undefined channel and shallow flow to deep, slow-moving ponds. This created barriers to both juvenile and adult salmon. The shallow areas present stranding issues during flow fluctuations on this dam-controlled river, as well as avian predation of

**Table 4-15 Structures on the Merced River**

smolts. During summer and fall flows, the shallow areas create a passage problem for spawning adults migrating upstream. The instream ponds provide habitat for predatory fish such as largemouth and smallmouth bass that prey on juvenile salmon. Juvenile salmon migrating downstream may become disoriented in the slow-moving waters of the pond and become vulnerable to predation.

Since the mid-1990s, DFG and DWR have initiated several projects to remediate the shallow reaches and instream ponds. The Magneson Pond Isolation Project, completed in 1996 at a cost of $450,000, isolated predator habitat, improved the adult and juvenile migratory pathway, and increased and enhanced riparian cover and spawning habitat for salmon.

A $20 million Merced River Salmon Habitat Enhancement Project will remediate 4.5 miles of abandoned mining pits and breached levees (Photos 4-24 and 4-25). In addition to achieving the results listed above, this project will also increase salmon rearing habitat, and improve floodplain dynamics by reconfiguring the channel to better conform to the dam-regulated flow and increasing the floodplain width from 400 to 1,400 feet. The project is protected in perpetuity with a conservation easement. This project has the support of the CALFED Bay-Delta Program, USBR and USFWS, the Central Valley Project Improvement Act AFRP, Wildlife Conservation Board, and local agencies and landowners. Additional funding has come from DFG Proposition 70 funds and the Tracy Fish Mitigation Agreement. Component river reaches include the $4.86 million Ratzlaff reach completed in 1999, the $8.02 million Robinson Reach constructed in 2001-2002, and Lower Western Stone and Western Stone Reaches are planned for 2005-2006.

The Central Valley Project Improvement Act will provide screening of 49 small pump diversions along the river. Also, increased enforcement of pollution control, poaching regulations, screening requirements, and streambed alterations are recommended (CH2MHill 1998). Additional actions include purchasing riparian and floodplain lands for habitat restoration.

Additionally, DFG and DWR, through the Delta Pumping Plant Agreement, currently augment coarse sediment into the Merced River at riffle rehabilitation sites.

**Photo 4-24 Merced River—Ratzlaff gravel pit before restoration (Merced County)/**DWR photo

**Photo 4-25 Merced River—Ratzlaff gravel pit after restoration (Merced County)/**DWR photo

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## Stanislaus River – Stanislaus County

There are about 16 gravel pits on the Stanislaus River that create instream ponds. Table 4-16 provides a partial list of these pits. The ponds provide habitat for predatory fish such as largemouth and smallmouth bass, which prey on juvenile salmon. The juvenile salmon migrating downstream become disoriented in the slow waters of the ponds and become extremely vulnerable to predation.

In September 1996, the Willems Project was approved and was expected to cost $2.7 million. One purpose of the project was to eliminate a 10.6-acre pond through which the Stanislaus River runs (Photo 4-26). The project included eliminating salmon-predator habitat, increasing salmon spawning and rearing habitat, improving the adult and juvenile salmon migratory pathway, improving floodplain dynamics by reconfiguring the channel to better conform to the present flow regime, and enhancing the riparian corridor. In March 1998, the project was stopped due to landowner concerns.

In November 2002 the FPIP, in cooperation with the Anadromous Fish Restoration Program, began developing the Oakdale Recreation Pond gravel pit isolation/restoration project to address losses of juvenile fish migrating downstream. Site visits and coordination meetings to initiate project development continued from February 2001 through early 2004. Since early 2004, program priorities have shifted to other projects. Future coordination and planning will continue to include local area government staff, landowners, USACE, USFWS, NMFS, DFG, San Joaquin District of DWR, and the State Water Resources Control Board. Preliminary restoration design began in 2002 and an initial public workshop about the potential project was also held. However, the project is currently on hold due to funding and staff constraints (Lampa 2004 Apr pers comm).

During 1999, 18 riffles were constructed between Knight's Ferry and the Lover's Leap stretches of the Stanislaus via CALFED funding. Funding from AFRP and DWR Four-Pumps is being allocated for a project to construct additional riffles and provide floodplain and side-channel habitat in the Lover's Leap reach of the Stanislaus (Wikert 2004 Nov pers comm.).

## Dennett Dam, Tuolumne River—Stanislaus County

The city of Modesto built Dennett Dam, a low, concrete structure, in 1933 for recreation (Table 4-17). It created a swimming and fishing lake on the Tuolumne River near Modesto (Photo 4-27). At one time there were fish ladders at each end of the dam, and during the 1940s there was a counting station for salmon. The dam fell into disuse and the concrete has been eroding. Later, the top portion of the dam was removed, but the footing remains, potentially creating a passage barrier to juvenile fish and to migrating sturgeon and American shad. It is also a hazard to recreational boaters.

In the 1970s DFG made a mid-channel breach to allow fish passage at low flows. It installed a fish ladder, but it washed away. DFG has investigated removing the structure. In addition, the San Joaquin River Management

**Table 4-16 Partial list of structures on the Stanislaus River**

**Photo 4-26 Stanislaus River—Oakdale Recreation Pond gravel pit isolation/restoration project/**USACE photo

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**Table 4-17 Structure on the Tuolumne River**

**Photo 4-27 Tuolumne River—Dennett Dam (Stanislaus County)/**DWR Photo

Program in its 1995 report identified the remnants of Dennett Dam as a potential fish passage barrier and recommended its removal. DFG biologists do not consider the dam problematic to adult migrating salmon or steelhead.

The city of Modesto has targeted the dam for removal as part of a master plan for development of the Gateway portion of the Tuolumne River Regional Park system. Gateway Park would be the centerpiece of the regional parkway in the city of Modesto along the Tuolumne River where Dennett Dam is located. DWR saw an opportunity to remove the dam sooner in conjunction with the 2002 replacement of the 9th Street bridge, which sits directly over the dam. DWR approached the city with this proposal; however, the bridge project was 95 percent planned with final CEQA and NEPA documents completed. There was not enough time in the planning schedule to alter the documents to include the dam removal and stay on schedule for the spring 2002 construction start.

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Recently, the city of Modesto refined the Tuolumne River Regional Park Master Plan and, with a $1,140,000 grant, prepared a Precise Plan for the 90-acre Gateway portion of the Master Plan. The Precise Plan focuses on restoration actions, trails placement, and location of other elements. Construction is scheduled to begin in spring of 2006 and be complete by fall 2006. The city is seeking other funding sources to support the establishment period which it hopes to begin in 2007.

In 1995 a FERC-mediated Settlement Agreement was signed by Merced Irrigation District, Turlock Irrigation District, the City and County of San Francisco, DFG, USFWS, FERC staff, Friends of the Tuolumne, Tuolumne River Expeditions, the Tuolumne River Preservation Trust, and the San Francisco Bay Area Water Users Association. The 1995 Settlement Agreement provided for increased minimum instream flows for fishery purposes, an expanded technical advisory committee, additional monitoring and studies to be conducted through 2004, and riparian habitat restoration projects (McBain and Trush 2000).

Under the 1995 FERC agreement there will be continued environmental review and design work for river.

Gravel has been placed in several locations along the river since 1999 and continued through summer 2003.

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