Central Valley Project Improvement Act

Public Law 102-575

ANNUAL REPORT

Fiscal Year 2008

Department of the Interior
U.S. Bureau of Reclamation
U.S. Fish and Wildlife Service

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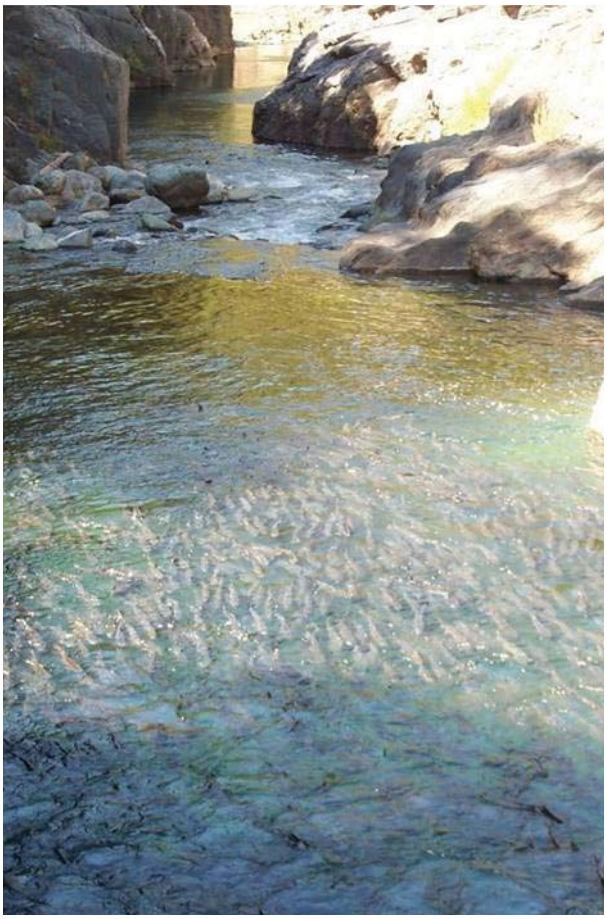
I. Executive Summary

Since 1992, Reclamation and the Service have worked cooperatively to implement the Central Valley Project Improvement Act (CVPIA or Act), making substantial progress towards sustainable doubling of natural populations of anadromous fish, recovery of listed species, habitat restoration, and provision of water for refuges. The successes to date would not be possible without the participation of the many partnering agencies and stakeholders who provide funding, collect data, and perform monitoring of ongoing activities. The program continues to build upon the knowledge gained from ongoing studies and modeling, and adapts future actions to reflect current data.

The CVPIA program managers convened a series of meetings in Fiscal Year (FY) 2008 to discuss the effectiveness of past actions and to identify priority watersheds and opportunities for coordinated actions that will maximize the effectiveness of program dollars. The outcome of these discussions will form the basis of a long-term implementation plan that will guide the program over the next 10 years. The CVPIA program is also conducting independent reviews for the fisheries program and the refuges water supply program. The independent review panels will provide programmatic recommendations to improve effectiveness and efficiency of the programs; these recommendations will be considered as the program develops the long-term plan.

For FY 2008, $59.1 million was appropriated in the Restoration Fund. Payments in to the Restoration Fund were $52.9 million. Of the $52.9 million, $1.8 million was received on September 30, 2008, and was not available for execution in FY 2008. This, in conjunction with the drought and delta pumping restrictions, produced a budget shortfall total of $8 million. $52.8 million was obligated from a combination of the Restoration Fund and Water and Related Resources account; approximately $41.4 million was obligated from the Restoration Fund and approximately $11.4 million was obligated from the Water and Related Resources account. Obligations in the Restoration Fund were offset by large recoveries in the Anadromous Fish Screen Program (AFSP) and Refuge Water Supply Program. The majority of these recoveries were not reobligated in FY 2008, but carried over into the next fiscal year. In FY 2009, an additional $4.4 million will be requested in restoration payments to make up the difference in 3407(d) offsets of FY 2008. To date, a total of $1.013 billion has been obligated to CVPIA since its implementation.



Spring-run Chinook salmon in Butte Creek

The enormity and complexity of the Central Valley ecosystem requires a comprehensive approach with

participation at all levels. The program must also contend with recent events such as drought and court ordered delta pumping restrictions. Continued progress towards the restoration goals of the program will be based on the ongoing partnerships with stakeholders and more closely coordinated implementation of activities

Progress Towards Goals

The following paragraphs summarize progress toward the broad goals of the CVPIA program - anadromous fish doubling goal; habitat restoration; and refuge water supply:

Anadromous Fish Doubling Goal

As of 2007, the average natural production for all races of Chinook salmon is 477,337, or approximately 48 percent of the doubling target. These numbers are the most recent numbers that have been through the Quality Assurance/Quality Control (QA/QC) process from the California Department of Fish and Game (DFG) Grand Tab. Updates and revisions are posted throughout the year on the Anadromous Fish Restoration Program (AFRP) website (www.delta.dfg.ca.gov/afrp/). Progress towards the doubling goal is a result of coordinated action between programs supporting improvements in passage, habitat, and flow. By focusing on these three critical components, CVPIA creates conditions in which fish populations can begin to recover in a sustainable fashion. Indeed, the greatest success in watersheds has occurred where these three components can be closely controlled, e.g., in Clear, Butte, and Battle creeks and the Mokelumne River. In all four of these areas, the doubling target has been either nearly met or exceeded.

Overall production trends are mixed:

- Winter-run production numbers have been trending upward since 1996, but showed a sharp decline in 2007
- Spring-run numbers have generally improved since 1991, but are still well below the target
- Fall-run production was increasing but declined precipitously in 2007
- Late fall-run production has increased from extremely low levels in the early 1990s, but is still well below the target

The AFRP continues to review anadromous fish production, life history requirements, restoration efforts, and the most current flow regimes in each watershed to better understand the requirements of sustainable doubling for these species in Central Valley rivers and streams.

Habitat Restoration

The Habitat Restoration Program has protected and restored nearly 100,000 acres since program inception, while the Land Retirement Program (LRP) has retired more than half of the 15,000 acres targeted as part of the pilot project. Of the 8,916 acres retired, the Land Retirement Program has restored more than 5,000 acres towards sustainable uplands habitat.

White-faced Ibis

Refuge Water Supply

CVPIA has created Full Level 4 capacity at 14 of the 19 identified refuges, paving the way for all 19 refuges to receive their Full Level 4 water supply. Capacity at the remaining five refuges will be addressed through construction projects planned and prioritized for the next 10 years. The high cost of water continues to limit acquisition of Full Level 4 water. Purchasing permanent or long-term water, rather than spot market

purchases, provides the most reliable source for refuge water, but these supplies are not readily available on the market and are very expensive when they can be found.

2008 ACCOMPLISHMENTS

The following section summarizes the specific FY 2008 accomplishments within the following categories: Anadromous Fish – Habitat Restoration; Anadromous Fish – Structural Actions; Refuges and Waterfowl; Other Fish and Wildlife; and Studies, Investigations, and Modeling.

Anadromous Fish – Habitat Restoration

- The Anadromous Fish Restoration Program FY 2008 activities included floodplain restoration on the Sacramento River National Wildlife Refuge (NWR), increasing spawning gravel on the Mokelumne River, and funding the permitting and environmental documentation for the Iron Canyon Fish Ladder on Big Chico Creek [(b)(1)]
- In water year 2008, which was critically dry, 600,000 acre-feet of (b)(2) water was available for fish actions; the 600,000 acre-feet was managed for fish, wildlife and habitat restoration purposes [(b)(2)]
- The Water Acquisition Program acquired 106,490 acre-feet of water (53 percent of the 200,000 acre-feet target) to improve instream flows and habitat restoration [(b)(3)]
- The (b)(9) Flow Fluctuation Program used (b)(2) water and re-operations pursuant to (b)(1)(B) to augment and maintain flows on Central Valley Project (CVP) streams to minimize losses of anadromous fish due to flow fluctuations
- The Clear Creek Restoration Program successfully met flow objectives related to controlling water temperature during critical seasons. Gravel was added at Whiskeytown Dam (1,000 tons), Placer Road Bridge (3,000 tons), Phase 3A (1,500 tons), and Phase 2A (3,000 tons) to increase spawning habitat [(b)(12)]
- The Spawning and Rearing Habitat Restoration Program purchased and placed approximately 8,300 tons of gravel in the Sacramento River; mapped Chinook redds on added gravel on the Stanislaus River; and permitted for and placed 7,000 tons of spawning gravel at Sailor Bar on the American River [(b)(13)]

Anadromous Fish – Structural Actions

- The Tracy (Jones) Pumping Plant program continued progress on the 23 total identified actions that make up the program target (14 actions have been completed as of 2008). FY 2008 activities included continuing research and pilot studies for improved debris and predator management, collecting water quality data at the entrance to the Delta Mendota Canal (DMC), and beginning construction of a new onsite research building [(b)(4)]
- The Contra Costa Canal Pumping Plant program continued to conduct fish monitoring; consulted under ESA and the Coordination Act with the U.S. Fish and Wildlife Service (Service) on the Los Vaqueros Biological Opinion (BO) as it relates to the environmental commitment of the Rock Slough Fish Screen; continued discussions with the Service for operation beyond the year 2008 in the absence of a screening facility; and continued to negotiate appropriate mitigation to the Service for the Sacramento-San Joaquin Delta Pelagic Organism Decline effort [(b)(5)]
- The Red Bluff Diversion Dam program implemented operational changes in 2007 to avoid further impacts to green sturgeon holding below the dam; no green sturgeon fatalities were observed in 2008. A Record of Decision was signed July 16, 2008, following completion of Endangered Species Act (ESA) consultation on the planned construction of the proposed new pumping plant; the plant will increase pumping capacity fourfold, providing a more reliable water supply [(b)(10)]
- The Head of Old River Barrier program installed a seasonal, temporary rock barrier at the head of Old River and continued additional planning and environmental compliance work on the permanent operable fish gate [(b)(15)]
- The Glenn-Colusa Irrigation District Program is 100 percent complete for related testing and monitoring for the project. The completed facility screens up to 105,000 acre-feet of firm annual water supply to 20,000 acres of Sacramento NWR lands. In 2008, the program completed hydraulic

testing and a set of underwater observations of predator distributions [(b)(20)]

- The AFSP completed construction on the Reclamation District (RD) 108 Poundstone Pumping Plant Fish Screen Project in Sutter County; this project consolidated three existing unscreened diversions into a new screened 300 cubic feet per second (cfs) diversion on the Sacramento River. The program also initiated a four-year screening and monitoring program on the Sacramento River which includes collection of fish loss data prior to installation of fish screens [(b)(21)]
- The Trinity River Restoration Program released flows of 647,000 acre-feet, completed construction of eight channel rehabilitation sites associated with the Lewiston-Dark Gulch Site Rehabilitation Project, and placed 14,300 cubic yards of gravel [(b)(1) ”other” and (b)(23)]

Refuges and Waterfowl

- In 2008, the Refuge Water Supply Program (RWSP) delivered 400,362 acre-feet of Level 2 and 37,066 acre-feet of Incremental Level 4 water. The program also negotiated a fourth amendment to extend the groundwater pumping reimbursement agreement with the DFG to supplement Level 2 water at Gray Lodge Wildlife Area up to the full Level 2 allocation [(d) (1), (2), and (5)]
- Major construction and preliminary testing of the Phase I, East Bear Creek Pumping Plant and Pipeline at the San Luis NWR was completed in 2008. To date, the refuge facilities construction program has completed 31 of the 46 actions or projects identified in the environmental documents and related design and specification documents [(d)(5)]

Other Fish and Wildlife

- The Habitat Restoration Program protected an additional 1,787 acres of new habitat and restored 1,908 acres of habitat. To date, the program has protected approximately 93,000 acres and restored approximately 7,400 acres [(b)(1) ”other”]
- The San Joaquin River Comprehensive Plan Program made progress on the development of specific operational guidelines for releasing Restoration Flows and the framework for a Recovered Water Account and made progress on the development of a Fisheries Management Plan [(c)(1)]
- In 2008, the Land Retirement Program restored 320 acres of former agricultural lands and eliminated the production of 3,500 acre-feet of poor quality agricultural drainage [3408(h)]

Studies, Investigations, and Modeling

- The Modified CVP Operations program reoperated the system multiple times to provide benefits to anadromous fish on Clear Creek without impacting other CVP obligations or authorized purposes and also completed draft reports for spring- and fall-run Chinook salmon and steelhead fry and juvenile rearing, as well as for redd dewatering and juvenile Chinook and steelhead stranding on the Yuba River [(b)(1)(B)]
- The Comprehensive Assessment and Monitoring Program (CAMP) completed an annual report that synthesizes and analyzes anadromous fish monitoring data collected between 1992 and 2007 on 21 watersheds; funded a cooperative agreement to develop statistical and structural design recommendations for a comprehensive database to document changes in the abundance of juvenile Chinook salmon in the Central Valley; and launched a program to develop watershed-specific documents that describe the relationship between restoration activities and the production of adult and juvenile Chinook salmon [(b)(16)]
- The Ecosystem and Water Systems Operations Models program currently operates the integrated CVP/State Water Project (SWP) model and seven other models – two more are currently under development. Reclamation and Service modelers continued the development and application of ecosystem models to evaluate the effects of reservoir operations and river flows on anadromous fish and riparian habitats on the Sacramento River. These activities included the use of several existing models including CalSim, Upper Sacramento River Water Quality Model (USRWQM) and Riparian Habitat Establishment Model (RHEM) [3406(g)]

II. Introduction

FY 2008

Funding Obligation

$41.4 million (Restoration Fund)

$11.4 million (Water and Related Resources)

Total

$52.8 million

Sunset at Kern National Wildlife Refuge

For the past 16 years, the CVPIA has guided the implementation of projects supporting the protection, restoration and enhancement of fish and wildlife associated with the CVP. The scope of CVPIA also covers a complex system of water transfers and contract renewals to ensure that adequate supplies remain available to support the restoration goals of CVPIA while also meeting demands of agriculture, municipal and industrial users, and power contractors. To date, more than $1.013 billion of federal, state, and private funds have been obligated to implement CVPIA mandates.

The CVP and other water projects have helped make the Central Valley the richest agricultural region in the nation and have also allowed California's population to grow beyond that of any other state. California leads the nation in water use - both surface water and groundwater; the ability to develop and use this precious resource has been a boon to the state's economy. The CVPIA has afforded the Department of the Interior (DOI or Interior) a prime opportunity to help restore conditions favorable for fish and wildlife in the Central Valley, while providing for continuation of its rich agricultural heritage and service to municipal and industrial users throughout the state.

This Annual Report summarizes the actions taken by the Bureau of Reclamation (Reclamation) and Service personnel, working with other federal agencies, the State of California, and numerous partners and stakeholders during fiscal year FY 2008 (October 1-September 30). Wherever possible, this report includes quantified goals and targets to more efficiently measure progress within each individual provision of the Act. In some instances, FY 2008 accomplishments were completed with funds that were obligated in prior years.

For greater detail on the programs and projects described in this report or on the progress towards achieving the Act's goals and objectives, please contact either Reclamation or the Service, or the individual CVPIA project and program managers.

BACKGROUND

The Central Valley Project's Role in California's Water Resources

For 73 years, California has depended on the CVP for a large part of its water needs, particularly for agriculture. With a climate typified by extremely variable precipitation, both temporally and regionally, the state relies heavily on dams and reservoirs to balance and manage its water resources, and on an extensive distribution system to convey water supplies for regional needs. Much of the state's water originates in the north and is conveyed southward, primarily through the Sacramento River system. Some water is diverted along the way, with the remainder flowing into the Sacramento-San Joaquin River Delta, where CVP water co-mingles with other supplies such as those of the SWP. A portion of the water entering the delta is pumped south; the majority discharges to the San Francisco Bay and Pacific Ocean. The CVP today comprises 18 dams and reservoirs (able to store 9 million acre-feet of water), 11 power plants, 500 miles of canals and aqueducts, three fish hatcheries, and associated facilities including pumping plants and power lines.

The ecosystems of the Central Valley, Delta Estuary, San Francisco Bay, and Trinity River are affected by water diversions–particularly in drought years–so much so that the courts have intervened to ensure that adequate fresh water enters these ecosystems. Compliance with the ESA and water quality mandates requires water releases from CVP dams to regulate water temperatures, salinity and instream flows, and limits water diversions to protect ESA-listed fish from the effects of pumping water at the Tracy Pumping Plant in the Delta. These factors have greatly increased the competition for existing water supplies and have focused scrutiny on the ways that water resources are being used.

Environmental conditions have changed greatly since the CVP was authorized in 1935. Population growth and development have increased farm, urban, and industrial water demands. Concurrently, populations of fish and wildlife have declined, resulting in some species being listed as endangered or threatened due to severe habitat loss. In response, a new imperative for resource management and ecological stewardship has evolved.

Central Valley Project Improvement Act of 1992

In one of its last actions of the session, the 102nd Congress in 1992 passed, and the President signed, the multi-purpose water legislation known as the CVPIA. Officially designated Title 34 of Public Law 102-575, this landmark piece of legislation mandates changes in the purposes and management of Reclamation's CVP. It specifically focuses Interior on the protection, restoration, and enhancement of fish and wildlife and associated habitats and contributes to the state's interim and long-term efforts to protect the San Francisco Bay/ Sacramento-San Joaquin River Delta Estuary. The Secretary of the Interior assigned primary responsibility for implementing CVPIA's many provisions to Reclamation and the Service, both agencies of Interior.

The purpose of the CVPIA is expressed in six broad statements found in Section 3402 of the Act:

(a) To protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California

(b) To address impacts of the CVP on fish, wildlife, and associated habitats

(c) To improve the CVP's operational flexibility

(d) To increase water-related benefits provided by the CVP to the state through expanded use of voluntary water transfers and improved water conservation

(e) To contribute to the state's interim and long-term efforts to protect the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary

(f) To achieve a reasonable balance among competing demands for use of CVP water, including the requirements of fish and wildlife, agricultural, municipal and industrial, and power contractors

The CVPIA Mandate

To achieve the CVPIA fish and wildlife restoration purposes and the identified goals and objectives, Congress incorporated specific programs, measures,

Figure 1. Central Valley Project System

and operational and management directives into the Act (Sections 3406 and 3408) that affect a wide variety of activities, including:

- Restoration of anadromous fish populations
- Water supplies for state and federal refuges and wildlife habitat areas
- Retirement of drainage-impaired agricultural lands
- Mitigation for other CVP-impacted fish and wildlife
- Revisions to water contracts
- Modification of water management and operations
- System-wide modeling to support decision-making
- Program monitoring to determine effectiveness
- Investigations and studies

Reclamation and the Service were joint lead federal agencies for the CVPIA Final Programmatic Environmental Impact Statement and its Record of Decision (PEIS and ROD). The PEIS and the ROD broadly identified the overall program and actions to achieve the purposes of CVPIA, including the fish and wildlife restoration provisions. Although some CVPIA provisions were implemented beginning in 1993, most were not initiated until after the ROD was signed in January 2000.

Reclamation and the Service cooperate and partner with other federal and state agencies, tribes and local organizations to implement CVPIA actions. Reclamation and the Service use interagency agreements, memoranda of understanding, grants, and cooperative agreements to partner with entities that have the authority, interest, ability, expertise, and/or resources to implement CVPIA restoration actions.

Implementation of the CVPIA program is federally funded primarily through two types of Congressional appropriations: Reclamation's Water and Related Resources account and the Restoration Fund established by CVPIA (Section 3407(c)(2)). (The Trinity River Restoration Program (TRRP) also has received Service appropriations of about $1.5 million per year for related monitoring activities.) The Restoration Fund is an account in the United States Treasury that receives funds generated through fees collected from CVP water and power contractor users, matching payments and contributions from the State of California, and donated funds. Reclamation is authorized to accumulate up to $30 million on a three-year rolling average basis (adjusted for inflation) in Restoration and Mitigation Payments from the CVP water and power users. A maximum of $50 million (adjusted for inflation) in annual appropriations from the Restoration Fund is allowed in any year under the CVPIA.

IMPLEMENTING THE CVPIA

Reclamation and the Service work cooperatively under Interior to implement the CVPIA. Reclamation's primary responsibilities involve engineering, water operations, water acquisitions, construction-related activities, and the submission of budgets and project funding. The Service has the responsibility for many biological issues including fish and wildlife restoration and related activities, such as managing the AFRP, Dedicated Yield, and CAMP. Program managers from each agency are assigned to develop and manage specific program activities in accordance with the applicable provisions of CVPIA. Although one agency generally is designated as the lead, both agencies contribute to annual work plans, budget and implementation responsibilities.

In implementing the restoration portion of CVPIA, Reclamation and the Service focus on three main fish and wildlife restoration initiatives:

- Achieving the anadromous fish doubling goal
- Providing adequate water to wildlife refuges
- Mitigating terrestrial and other CVP-related impacts

In addition to these fish and wildlife initiatives, the program focuses on improving operational flexibility and modeling.

The CVPIA also includes specific provisions to guide restoration in the Trinity River basin. The Trinity River is the Klamath River's largest tributary, and is geographically separate from the Central Valley and the Sacramento River. However, substantial water from the Trinity River has historically been exported through a trans-basin diversion to support water needs in the Central Valley. When the CVPIA was enacted, section (b)(23) of the law was specifically included to direct future Trinity River flows and restoration actions.

Anadromous Fish Doubling Goal

The Act directs Interior to

"… implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991…"

The anadromous fish doubling goal pertains to Chinook salmon, steelhead, striped bass, American shad and sturgeon, which are believed to have been affected by CVP construction and operation.

Many of the CVPIA provisions support this goal directly or indirectly. Section (b)(1), which authorizes the AFRP, is wholly devoted to this purpose, and its process to identify reasonable restoration actions is in the 2001 Final Restoration Plan for the AFRP (AFRP Restoration Plan). Actions contained within the AFRP Restoration

Plan were determined to be reasonable given numerous technical, legal, and implementation considerations; all AFRP actions are covered in the CVPIA PEIS/ROD.

Other CVPIA provisions that support the fish doubling goal include the fish screening activities conducted under (b)(4) Tracy (Jones) Pumping Plant Program, (b)(5) Contra Costa Canal Pumping Plant Program, (b)(17) Anderson-Cottonwood Irrigation District Diversion Dam, (b)(20) Glenn-Colusa Irrigation District Program, and (b)(21) AFSP; restoration activities such as (b)(12) Clear Creek Restoration Program and (b)(13) Spawning and Rearing Habitat Restoration Program; and the many modeling and monitoring programs that provide data to support reoperation and restoration activities, namely, (b)(16) CAMP, (b)(1)(B) Modified CVP Operations, and 3406 (g) Ecosystem and Water Systems Operations Model.

Wildlife Refuges

The CVPIA includes several provisions that are designed to contribute to the restoration of wetlands and wildlife habitat.

The Act directs Interior to

"…provide, either directly or through contractual agreements with other appropriate parties, firm water supplies of suitable quality to maintain and improve wetland habitat areas on units of the National Wildlife Refuge System in the Central Valley of California; on the Gray Lodge, Los Banos, Volta, North Grasslands and Mendota state wildlife management areas; and on the Grasslands Resources Conservation District…"

The quantity and delivery schedules of refuge water are governed by the concepts of Level 2 and Level 4 which are outlined in more detail in the Refuges sections of this report. CVPIA quantifies the specific amount of water that is to be supplied and authorizes Interior to acquire water conveyance capacity from non-federal entities and construct conveyance facilities as necessary for the delivery of water supplies to the refuges (Figure 2.)

Other Resources

The third focus of the CVPIA is directed at terrestrial species and habitats and other resource impacts of the CVP. Provisions supporting this initiative include the (b)(1)"other" Habitat Restoration Program (HRP), which focuses on protecting native habitats that have been directly and indirectly affected by the CVP's construction and operation, and the 3408(h) LRP, which purchases and retires land from agricultural production to improve water quality and provide for terrestrial habitat restoration.

FUNDING FOR ACTIVE PROVISIONS

While there were no cost estimates associated with the CVPIA in 1992, Congress has provided substantial annual appropriations of Restoration Funds and Water and Related Resources funds. As of 2008, a total of $1.013 billion has been obligated to CVPIA since its implementation in 1993 (Figure 3). For FY 2008, $59.1 million was appropriated in the Restoration Fund. Payments into the Restoration Fund were $52.9 million. Of the $52.9 million, $1.8 million was received on September 30, 2008, and was not available for execution in FY 2008. This, in conjunction with the drought and delta pumping restrictions, produced a budget shortfall total of $8 million. $52.8 million was obligated from a combination of the Restoration Fund and Water and Related Resources account; approximately $41.4 million was obligated from the Restoration Fund, and approximately $11.4 million was obligated from the Water and Related Resources account. Obligations in the Restoration Fund were offset by large recoveries in the AFSP and RWSP. The majority of these recoveries were not reobligated in FY 2008, but carried over into the next fiscal year. In FY 2009, an additional $4.4 million will be requested in restoration payments to make up the difference in 3407(d) offsets of FY 2008.

Several CVPIA provisions are now complete and/or otherwise not funded in the FY 2008 cycle. As such, the following provisions are not discussed in this report:

- 3406 (b)(6) Shasta Temperature Control Device (Complete)
- 3406 (b)(7) Meet Flow Standards and Objectives (Ongoing through operations)
- 3406 (b)(8) Short Pulse Flows (Ongoing through operations)
- 3406 (b)(14) Delta Cross and Georgiana Slough (Inactive)

Figure 2. Central Valley Refuges Receiving CVPIA Water Supplies

- 3406 (b)(17) Anderson-Cottonwood Irrigation District Diversion Dam (Complete)
- 3406 (b)(18) Restore Striped Bass Fishery (Inactive)
- 3406 (b)(22) Waterfowl Incentive Program (Complete)
- 3406 (c)(2) Stanislaus River Basin Water Needs (Complete)
- 3406 (d)(6) Central Valley Wetlands Supply (Complete)
- 3406 (e) Supporting Investigations (Complete)
- 3406 (f) Project Fisheries Impact Report (Complete)
- 3408 (i) Water Conservation (Complete)
- 3408 (j) Water Augmentation (Yield Study) (Complete)

The remaining provisions were eligible to receive appropriations to support FY 2008 program activities. Table 1 lists each active provision and the amount of funding provided.

CONTRACTS AND WATER TRANSFERS

In addition to the work funded through the Restoration Fund and the Water and Related Resources account as outlined in the previous section, Reclamation also provides funding to administer contract renewals and water transfers to support the CVP's ongoing operations.

Contract Renewals

Since the passage of CVPIA, Reclamation has completed interim and long-term contract renewals for the various CVP divisions and units. To date, Reclamation has executed 130 long-term renewal contracts with Sacramento River Water Right Settlement contractors; 95 long-term renewal contracts with contractors from the Tehama-Colusa, Delta-Mendota Canal, and Friant divisions; and 21 interim-renewal contracts with Cross Valley, San Luis, and other Delta-Mendota contractors. There are currently 15 Sacramento River Water Right Settlement contractors that elected not to renew and two pending renewal.

The eight Cross Valley contracts are currently conducting long-term renewal negotiations; Reclamation and the San Luis Unit contractors have completed negotiations for their long-term renewal contract, and are awaiting execution pending completion and acceptance of the Operations Criteria and Plan (OCAP) which is currently undergoing final environmental consultations with the Fish and Wildlife Service and the National Oceanic and Atmospheric Administration (NOAA) Fisheries.

Upon completion and acceptance of OCAP, Reclamation will offer to enter into long-term negotiations with the eight remaining contractors whose contracts do not expire until between 2010 and 2022. It is anticipated that the OCAP will be completed in summer 2009, and long-term contract renewals can be fully completed by the beginning of water year 2011.

Water Transfers

Water transfers are a means by which existing water supplies can be reallocated from one user to another to assist in meeting existing and future water needs within the state.

In order to assist California urban areas, agricultural water users and others in meeting their future water needs, CVPIA specifically authorizes all individuals or districts – who received CVP water under contract – to transfer, subject to certain terms and conditions, all or a portion of the water they receive under such contracts to other water users within the state for any purpose recognized as beneficial under state law.

As of mid-December 2008, Reclamation has approved the transfer of CVP water in the following categories for the 2008 water year:

- 328,187 acre-feet of CVP agricultural water was approved for agricultural purposes
- 1,200 acre-feet of CVP agricultural water was approved for municipal and industrial purposes
- 2,600 acre-feet of CVP municipal and industrial water was approved for agricultural purposes
- 3,250 acre-feet of CVP municipal and industrial water was approved for municipal and industrial purposes
- 26,425 acre-feet of CVP agricultural water approved to Reclamation's Refuge Water Acquisition Program

RECENT DEVELOPMENTS

The CVPIA Program faces several challenges. First, is the scope and overall complexity of the project which is a long-term effort to restore the Central Valley ecosystem that involves federal, state, local and tribal entities, as well as public and private interests. Compounding the program complexity are recent events on the regional, national, and international scale, such as court ordered delta pumping restrictions, west coast salmon fishery closure, and climate change. The drought in California continued in Water Year (WY) 2008 (October 1 – September 30) which was classified as a critically-dry year. These conditions impact water deliveries for agriculture and municipal and industrial users as well as affecting the availability and cost of water to purchase on the open market for refuge water deliveries. Several recent developments will have a direct effect on the implementation of CVPIA actions, including the Pelagic Organism Decline (POD), litigation of BO, the OCAP BO's, the Office of Management and Budget (OMB) Program Assessment Rating Tool (PART) process, outcome of independent

Table 1. FY 2008 Funding Obligations by Provision

	Provision	Water & Related Funds*	Restoration Funds*		State*
3406(b)(1)	Anadromous Fish Restoration Program	0	$2,957,000		
3406(b)(1)	"other" - Habitat Restoration Program	0	$1,346,000		
3406(b)(1)	"other - Trinity River Restoration Program	$ 5,176,000	$1,647,000		
3406(b)(1)(B)	Modified CVP Operations	0	$509,000		
3406(b)(2)	Dedicated 800,000 acre-feet Project Yield	0	$817,000		
3406(b)(3)	Water Acquisition Program - Instream Water (includes 3408 (g) [Vernalis Adaptive Management Plan (VAMP)])	0	$3,750,000 $2,964,000 $6,782,000	 (VAMP) Level 4	$1,332,000
3406(b)(4)	Tracy (Jones) Pumping Plant Program	$1,815,000	0		($14,970)
3406(b)(5)	Contra Costa Canal Pumping Plant	$55,000	0		($2,500)
3406(b)(9)	Flow Fluctuations	0	$31,000		
3406(b)(10)	Red Bluff Diversion Dam	$5,636,000	0		($2,000)
3406(b)(11)	Coleman National Fish Hatchery	$826	0		
3406(b)(12)	Clear Creek Restoration Program	$99,000	$611,000		
3406(b)(13)	Spawning and Rearing Habitat Restoration Program	0	$883,000		$878
3406(b)(15)	Head of Old River Barrier	0	0		
3406(b)(16)	Comprehensive Assessment and Monitoring Program	0	$291,000		
3406(b)(19)	Reservoir Storage	0	0		
3406(b)(20)	Glenn-Colusa Irrigation District Program	$71,000	0		
3406(b)(21)	Anadromous Fish Screen Program	($3,144,000)	($1,310,000)		($178,433)
3406(b)(23)	Trinity River Restoration Program	$1,685,000	$3,000		
3406(c)(1)	San Joaquin River Comprehensive Plan	0	$7,733,000		
3406(d)(1)	Refuge Water Supply	Level 2 conveyance included in (d)(5)	Level 2 conveyance included in (d)(5)		
3406(d)(2)	Refuge Water Supply	Level 4 acquisition included in (b)(3)	Level 4 acquisition included in (b)(3)		
3406(d)(5)	Refuge Facilities Construction Program	0	$10,264,000 $137,000	(construction) (wheeling)	
3406(d)(5)	San Joaquin Basin Action Plan Lands Program	$42,000	$941,000		
3406(g)	Ecosystem and Water Systems Operations Models	$735	$402,000		
3408(h)	Land Retirement Program	0	$630,000		
TOTAL FUNDING OBLIGATED		$11,436,561	$41,388,000		$1,134,975

* Rounded for presentation purposes
Amounts in ( ) = credit amount

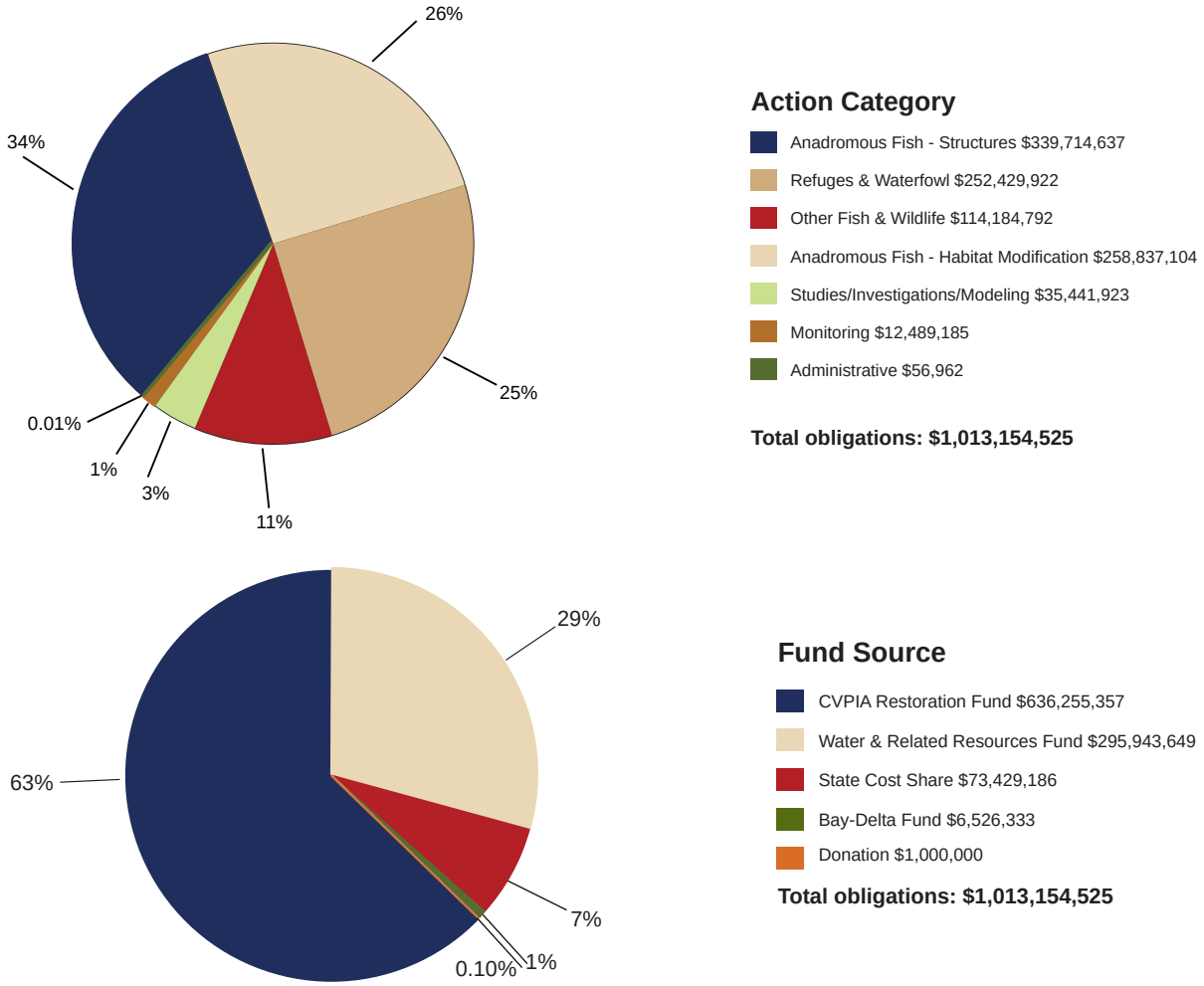


Figure 3. Total CVPIA Obligations by Action Category and Fund Source (1993-2008)

reviews, and the development of a long-term plan for CVPIA implementation.

Pelagic Organism Decline

Abundance indices calculated by the Interagency Ecological Program (IEP) through 2008 show continued marked declines in four pelagic fishes in the upper San Francisco Estuary (the delta and Suisun Bay). These fishes include two native species, delta smelt and longfin smelt, and two non-native species, age-0 striped bass, and threadfin shad. Delta smelt has recently been uplisted to endangered under the state ESA and remains listed as threatened by the federal ESA. The state has also recently listed longfin smelt as threatened. The abundance of both delta smelt and threadfin shad dropped to new record lows in 2008, while the abundance of longfin smelt and age-0 striped bass remained very low.

Several CVPIA provisions including (b)(4) Tracy (Jones) Pumping Plant Program, (b)(5) Contra Costa Canal Pumping Plant, and (b)(15) Head of Old River Barrier have been affected as diverters reduced pumping in response to the decline in delta smelt. The decline has also heightened the need to improve fish protection in the south delta and at the intake to Contra Costa Canal to further minimize the loss of these pelagic fish species due to exports. Revised federal ESA BO's are being issued or have been issued by the Service and National Marine Fisheries Service (NMFS) that specifically address the need for additional fish protection due to exports.

Litigation of Biological Opinions

On December 14, 2007 (FY 2008), a federal judge (U.S. District Court Judge Oliver Wanger) ordered state and federal water project managers to reduce the amount

of water pumped from the Sacramento-San Joaquin River Delta to protect the threatened delta smelt from extinction in the Service BO.

Judge Wanger ruled in an Interim Remedial Order that caused the projects to restrict water deliveries from the California delta's export pumps to the Bay Area, Central Valley, and Southern California to protect the fish. The ruling ordered a reduction in pumping from the end of December (when the fish are ready to spawn) until June (when the fish can move into Suisun Bay beyond the reach of the pumps).

On April 16, 2008, Judge Wanger determined that the NMFS 2004 BO (see following section) was incomplete and did not analyze the recovery of winter-run and spring-run Chinook salmon and steelhead species, or the effect global climate change may have over the next 25 years. Reclamation has not been ordered to follow interim restrictions.

Operations Criteria and Plan Biological Opinions

The OCAP Biological Assessment (BA) provides a detailed project description of the CVP system as a whole, including operations, modeling, and forecasting. The OCAP BA also contains an analysis of the effect of CVP operations on federally-listed threatened and endangered species, providing a basis for consultation with NMFS and the Service regarding mitigation to reduce those effects. The Service and NMFS must issue a BO stating its conclusions about OCAP's potential effects and presenting mitigation requirements that will be applied to specific CVPIA programs.

The current NMFS BO was issued in October 2004 and the Service BO was issued in February 2005. A new OCAP Service BO was issued in December 2008. The court has directed NMFS to issue its BO March 2009, but like the Service, the new BO will be issued June 2009. The ESA consultation for the operation of the proposed new pumping plant at Red Bluff (b)(10) and the planned barrier at Old River (b)(15) will follow the revised OCAP BO issuance to ensure that future program activities comply with OCAP mitigation requirements.

Program Assessment Rating Tool

The OMB PART was developed to assess and improve the performance of federal programs. A PART review helps identify a program's strengths and weaknesses to inform funding and management decisions aimed at making the program more effective. The PART therefore looks at all factors that affect and reflect program performance including program purpose and design; performance measurement, evaluations and strategic planning; program management; and program results. Because the PART includes a consistent series of analytical questions, it allows programs to show improvements over time and allows comparisons between similar programs.

A PART was performed for CVPIA in 2006, and the program was given a rating of "adequate." OMB required several improvements actions, some of which were implemented in 2007 and some which extended into FY 2008. The major actions include completing program independent reviews by a panel of experts and completing a long-term plan to guide CVPIA actions over the next 10 years (2010 through 2019); these reports are due in FY 2008 and FY 2009.

Independent Review

An independent review is a process through which a panel of experts evaluates a program and makes recommendations to improve its effectiveness. Each panel is comprised of independent professionals and academics with expertise in relevant areas. The overall purpose of these independent reviews is to provide programmatic recommendations and guidance to the CVPIA program to improve effectiveness and efficiency, understand how to organize the program, and maximize restoration progress in a time of limited resources.

Reclamation and the Service are sponsoring two independent reviews: one to evaluate the fisheries program and one to evaluate the RWSP. The reviews are funded by the Bureau of Reclamation budget for the CVPIA Program. Reclamation and the Service decided to conduct the evaluations on the program elements related to fish restoration and refuges as these two elements represent a substantial portion of the annual Restoration Fund expenditures.

The purpose of the fisheries independent review is to seek recommendations on how to implement the CVPIA fisheries programs more efficiently and effectively to reach the fish doubling goals described in Section 3406(b)(1) of the Act. The fisheries independent review convened preparatory panel sessions where program managers presented the scientific, program management, and other background information used to support the fishery restoration plans and activities. The six-member panel convened privately to review the program and develop draft recommendations. The preparatory panel sessions and the panel deliberation sessions were conducted May 2008 through October 2008. The final report from the fisheries independent review panel was submitted to Reclamation and the Service on December 16, 2008. The independent review panel provided valuable recommendations for improving the CVPIA fish restoration program, including recommendations to improve the program's science-based framework, reorganize the program structure and management, improve program implementation by making full use of CVPIA authorities, and improve collaboration.

The purpose of the refuges independent review is to seek recommendations on how to implement the CVPIA RWSP more efficiently and effectively to reach the goals of providing full Level 4 water. The independent refuges evaluation is focused on the Central Valley refuges goals described in Sections 3406(d) (1 – 5) of the Act. The refuges independent review convened preparatory panel sessions in February 2009 to present the scientific, program management, and other background information used to support the refuges restoration plans and activities. The five-member panel will convene privately to review the program and develop draft recommendations. The panel deliberation sessions will be conducted between March 2009 and May 2009. The final report from the refuges independent review panel will be produced by June 30, 2009.

Reclamation and the Service will consider the recommendations of the panels as they develop the Long-term Plan that will guide program priorities and activities over the next 10 years.

Long-term Plan

The CVPIA Program is developing a Long-term Plan (LTP) that will provide focus and direction for the CVPIA Program for the coming 10 years (2010-2019); it will provide the foundation for planning, budgeting, performance management, and accountability processes. The LTP focuses on providing objectives and strategies for the following areas: Fisheries, Refuges, Other Resources, and CVPIA Program Management.

The LTP will be developed through internal processes using independent review panel recommendations. The internal process includes participation by Reclamation and Service program managers, biologists, and engineers that are involved in the day-to-day work of Program implementation; these meetings will culminate with the development of prioritized activities in each of the resource areas. As stated above, independent review panels are reviewing Program accomplishments and preparing recommendations for Fisheries and Refuges regarding priorities and efficiencies to maximize progress towards the restoration goals. As the independent review panels complete their work, the recommendations will be considered for incorporation into the priorities and strategies in the LTP.

With priorities in place, the next steps will be to establish benchmarks for measuring progress in restoring the ecosystem. The Program needs to develop longer term or interim outcome oriented goals that will serve as a blueprint of how the restoration will occur. This process will come full circle as the Program evaluates these performance data to develop future LTP's.

LOOKING AHEAD

Quantifying goals and results will be increasingly important as Reclamation and the Service seek to focus program dollars on areas that can provide the greatest return on investment (ROI). In the case of this portion of CVPIA, currently funded through the Restoration Fund and focused on Restoration efforts, ROI is measured generally by increases in the natural production of anadromous fish, the delivery of water to wildlife refuges that is of suitable quality and quantity, the protection and restoration of sensitive species and habitats, the retirement and restoration of agricultural lands, the completion of structural improvements, and the implementation of operational changes to affect flows. The program also measures completion of restoration activities pursuant to the Trinity River Restoration Plan, and additional specific goals exist for individual CVPIA program activities, as discussed throughout this annual report.

The data generated from CVPIA modeling and monitoring activities support the identification of these performance targets and also provide results and feedback on the effectiveness of actions. Planning and coordination between the various provisions will increase the effectiveness of resource allocation and decision-making. Closer coordination between the programs is seen as critical to the success of CVPIA's long-term goals.

III. 2008 Program Activities and Accomplishments

This section summarizes FY 2008 program accomplishments and funding obligations for each active provision. Wherever possible, each section includes quantified goals and targets to measure progress towards the Act's implementation. The following program activities are discussed in this section:

Hocker Flat Rehabilitation Site, Trinity River

- 3406 (b)(1) AFRP
- 3406 (b)(1) "other" Habitat Restoration Program
- 3406 (b)(1) "other" & (b)(23) Trinity River Restoration Program
- 3406 (b)(1)(B) Modified CVP Operations
- 3406 (b)(2) Dedicated 800,000 acre-feet Project Yield
- 3406 (b)(3) & (g) Water Acquisition Program – Instream Water
- 3406 (b)(4) Tracy (Jones) Pumping Plant Program
- 3406 (b)(5) Contra Costa Canal Pumping Plant
- 3406 (b)(9) & (b)(19) Flow Fluctuations and Reservoir Storage
- 3406 (b)(10) Red Bluff Diversion Dam
- 3406 (b)(11) Coleman National Fish Hatchery
- 3406 (b)(12) Clear Creek Restoration Program
- 3406 (b)(13) Spawning and Rearing Habitat Restoration Program
- 3406 (b)(15) Head of Old River Barrier
- 3406 (b)(16) CAMP
- 3406 (b)(20) Glenn-Colusa Irrigation District Program
- 3406 (b)(21) AFSP
- 3406 (c)(1) San Joaquin River Comprehensive Plan
- 3406 (b)(3) & (d)(2) Water Acquisition Program – Refuge Water
- 3406 (d)(5) Refuge Facilities Construction and San Joaquin Basin Action Plan Lands Programs
- 3406 (d)(1), (2) & (5) Refuge Water Conveyance (Wheeling)
- 3406 (g) Ecosystem and Water Systems Operations Models
- 3408 (h) LRP

Tule Elk, San Luis National Wildlife Refuge

Anadromous Fish Restoration Program

FY 2008

Funding Obligation

$2,957,000 (Restoration Fund)

Accomplishments

- The program conducted several activities to improve habitat for anadromous fish by providing flows and improved physical habitat including: floodplain restoration on the Sacramento River NWR; increasing spawning gravel on the Mokelumne River; channel reconstruction and gravel augmentation in the Cosumnes River; and funding proposals for floodplain and side-channel enhancement projects on the Stanislaus, Tuolumne, and Merced rivers
- The program worked to improve survival rates of juveniles at diversions by funding a feasibility study to construct a bypass for out-migrating salmonids at two screened diversions in Antelope Creek
- The program continued to improve the opportunity for adult fish to reach their spawning habitats by funding the permitting and environmental documentation for the Iron Canyon Fish Ladder on Big Chico Creek and the Lower Calaveras River Anadromous Fish Barrier Project
- The program conducted several activities to collect fish data to facilitate evaluation of restoration actions by conducting an experimental gravel injection at Englebright Dam and video weir monitoring for Bear, Cottonwood, and Cow creeks

CVPIA Section 3406(b)(1)

"The Secretary . . .is authorized and directed to . . . develop within three years of enactment and implementation a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels, attained during the period of 1967-1991." The section also states, "this goal shall not apply to the San Joaquin River between Friant Dam and the Mendota Pool, for which a separate program is authorized under subsection 3406(c) of this title; Provided further, That the programs and activities authorized by this section shall, when fully implemented, be deemed to meet the mitigation, protection, restoration, and enhancement purposes established by subsection 3406(a) of this title; And provided further, That in the course of developing and implementing this program the Secretary shall make all reasonable efforts consistent with the requirements of this section to address other identified adverse environmental impacts of the Central Valley Project not specifically enumerated in this section."

Based on the Act's language, Interior developed the AFRP as the overarching program to address anadromous fish doubling in the Central Valley. The CVPIA goal is to at least double the natural production of anadromous fish on a long-term, sustainable basis. The specific system-wide doubling targets for natural production of anadromous fish are categorized by fish run/species, per year:

- Chinook salmon
  - Winter-run 110,000
  - Spring-run 68,000
  - Fall-run 750,000
  - Late Fall-run 68,000
- Steelhead 13,000
- Green sturgeon 2,000
- White sturgeon 11,000
- Striped bass 2,500,000
- American shad 4,300

Subsequent to the Act's passage, the AFRP developed a series of planning reports that culminated in the Final AFRP Restoration Plan (Plan) in 2001. As acknowledged in the CVPIA ROD, the Plan guides the implementation of the actions and evaluations which were developed to address the doubling goal. The 289 actions and evaluations in the Plan are categorized by six programmatic-level objectives:

1) Improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat
2) Improve survival rates by reducing or eliminating entrainment of juveniles at diversions
3) Improve the opportunity for adult fish to reach their spawning habitats in a timely manner
4) Collect fish population, health, and habitat data to facilitate restoration actions evaluation
5) Integrate habitat restoration efforts with harvest and hatchery management
6) Involve partners in implementing and evaluating restoration actions

AFRP projects implemented from actions and evaluations in the Restoration Plan since 1995 have addressed environmental limiting factor categories that were derived from Central Valley watershed limiting factors listed in the AFRP Working Paper. The Working Paper was developed under the direction of a scientific core group composed of experts from state and federal agencies, private industry, and academia with specific knowledge of anadromous fish species in Central Valley rivers and streams. It lists potential factors or stressors that may limit natural production of anadromous fish and the ideal type and number of restoration actions that, if implemented in their entirety, would address these factors and likely result in at least doubling natural production of anadromous fish.

Measuring Success

Key actions and evaluations undertaken or completed in 2008 include the following (grouped by program objectives):

Objective 1: Improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat

Deer Creek – In order to address Deer Creek's Final Restoration Plan Actions 1 and 3, critical riffles identified by the California Department of Fish and Game (DFG) on Deer Creek were assessed to identify a range of critical flows needed for upstream passage of adult salmonids. In addition to the flow analysis, recommendations of potential solutions to correct passage problems at the critical riffles were also identified. AFRP provided FY 2004 funds for this project and reports are available on the AFRP website (www.delta.dfg.ca.gov/afrp/).

Sacramento River – On the mainstem Sacramento River, phase II of the La Barranca unit of the Sacramento River NWR was funded to remove the 116 acre orchard, prepare the site and write a vegetation restoration plan (Final Restoration Plan Action 9 and Evaluations 1,5). The restoration plan will develop two options for planting designs based on the hydrologic, geologic, edaphic (soil), biologic (baseline special status species, migratory birds, plants and vegetation) and historic conditions at the site, and outline the implementation strategies for the site. The plan will include a fully irrigated restoration design option and a dry land restoration option for native grasses, forbs, and valley oak acorns. The plan will specify targeted wildlife species that will benefit from the future restoration of the site and identify the numbers of plants and seeds required for the full restoration of the site.

Mokelumne River – During FY 2008, funds were provided to purchase spawning gravel materials used for an ongoing project to increase spawning gravel quantity and improve gravel quality at known spawning sites for fall-run Chinook salmon and steelhead downstream of Camanche Dam. This gravel replenishment project is in partnership with the East Bay Municipal Utility District (EBMUD) and addresses Actions 2 and 7 of the Final Restoration Plan for this watershed. Gravel was purchased and placed in channel, and the enhanced habitat continues to provide opportunity for increased

natural production of Chinook salmon and steelhead. This project area is rigorously characterized each year for spawning use, bed form and function, and provides a foundation project for the Spawning Habitat Integrated Rehabilitation Approach (SHIRA) as conducted by the University of California (UC) Davis. Final reports are available on the AFRP website.

Cosumnes River – Permitting and final phases of project planning were completed in time to begin the channel reconstruction and gravel stockpiling and placement for the Cosumnes Passage and Habitat Improvement Project (Final Restoration Plan Action 6, Evaluation 2). The project will improve adult salmonid passage and enhance habitat by reconfiguring the channel and adding spawning gravel for both immediate use and subsequent year recruitment resulting in overall improved survival and reproduction for Chinook salmon. This project will reconfigure the channel bed to provide more and higher quality spawning gravel as well as place gravel upstream for continual gravel recruitment with flow events over the course of several years. Gravel has been stockpiled on site and is readily available for placement over consecutive years. AFRP is collaborating with Fishery Foundation of California, Omochumne-Hartnell Water District, Robertson-Bryan, Inc., and DFG and has leveraged $232,500 in cost share and in-kind services to date for this effort.

Stanislaus River – Two new floodplain and side-channel enhancement projects were funded (Honolulu Bar and Lancaster Road) to increase juvenile salmonid rearing habitat and decrease predation (Final Restoration Plan Action 2). Tours of restoration sites on the river were provided to attendees of the Salmonid Restoration Federation annual meeting and to the CVPIA Fisheries Independent Review Panel. Community outreach activities were also initiated during 2008 as well as the development of a draft Outreach Plan and a draft Fisheries Restoration Plan.

Objective 2: Improve survival rates by reducing or eliminating entrainment of juveniles at diversions

Antelope Creek – Currently there are two diversions at Edwards Dam that are screened; however no bypass was constructed due to the site's complexity. The screens are a fair distance down the irrigation canals. During dry years, irrigation starts earlier in the spring and juvenile salmonids get stranded in the canals. FY 2008 funds were awarded to the Tehama County Resource Conservation District to conduct a feasibility study to determine the best solution to get out-migrating salmonids back into Antelope Creek. This project is a cooperative effort between the U.S. Fish and Wildlife Service (FWS), DFG, National Marine Fisheries Service (NMFS), Los Molinos Mutual Water Company, and the landowner. The feasibility study and environmental compliance should be complete in FY 2009.

Battle Creek – The Orwick fish screen improvement project was completed. This project was funded in FY 2006 by AFRP. The fish screen will prevent entrainment of juvenile salmonids and straying of adult Chinook salmon at Battle Creek (Final Restoration Plan Action 4).

Butte Creek – Review of the draft report for the Five Points/Avis Channel Fish Passage and Entrainment Assessment was completed in June 2008. Comments on the draft report for the Butte Slough/Sutter Bypass Fish Entrainment Study are under way. Both of these evaluation projects were funded with FY 2006 AFRP funds and address Evaluations 1-9 for Butte Creek in the Final Restoration Plan. Preliminary results for both reports show that implementing the potential

Cosumnes River Habitat Improvement Project - Before (Top) and After (Bottom)

actions (screens) would reduce entrainment and contribute to increases in juvenile-to-adult survival of Butte Creek spring-run Chinook salmon, though the individual benefits of the potential actions on population performance appears to be small due to other diversions in the system that still need to be addressed.

Objective 3: Improve the opportunity for adult fish to reach their spawning habitats in a timely manner

Antelope Creek – Antelope Creek is an eastside tributary to the upper Sacramento River in Tehama County. The DFG has operated a fish ladder at the Antelope Creek Edwards Dam since 1981. The ladder and dam had been damaged on a number of occasions, most recently in the January 1997 flood event, and it did not adequately pass upstream migrating anadromous salmonids. A DFG fish passage engineer designed an improved ladder, and the DFG Red Bluff Screen Shop constructed the ladder in the fall of 2007, with AFRP FY 2005 funds. DFG monitors adult spring run Chinook escapement in the watershed and data is reported in the DFG Grantab that is available on the AFRP website. This was a cooperative effort with FWS, DFG, NMFS, the Los Molinos Mutual Water Company, and the landowner.

Antelope Creek Edwards Dam Fish Ladder – Before (Top) and After (Bottom)

Big Chico Creek – Funds were provided to complete the permitting and environmental documentation required to begin construction of the Iron Canyon Fish Ladder, which will provide more consistent access to an estimated 8 miles of quality spring-run Chinook salmon habitat (Final Restoration Plan Action 2). The final phases (phases 3 and 4) are expected to be completed in 2009.

Butte Creek – Final Restoration Plan Action 18 was completed during this reporting period with the construction of the White Mallard Dam and fish ladder. The White Mallard Dam project was funded in FY 2003 by AFRP to facilitate passage and reduce entrainment at this facility, benefiting salmonid survival and production.

Cow Creek – Clover Creek, tributary to Cow Creek, has an agricultural dam and exposed siphon, both of which are complete barriers. AFRP provided FY 2007 funds to the Western Shasta Resource Conservation District for the Millville Diversion Environmental Compliance Project to complete all environmental compliance documents necessary to obtain permits to modify the diversion dam and siphon for fish passage, as designed. This project will open up 10 miles of historic habitat to fall-run Chinook and Central Valley steelhead trout, a federally-listed Threatened species. This is an interagency effort with California Department of Water Resources (DWR), DFG, CALFED Ecosystem Restoration Program (ERP), and the Natural Resource Conservation Service (NRCS). The DWR Fish Passage Improvement Program is providing initial engineering design. CALFED ERP is providing implementation funds. The project consists of removing the dam and siphon, installing agricultural grade pumps, and constructing a solar array to offset pumping costs. The environmental compliance effort is ongoing and should be completed in FY 2009. This project is but one of many steps required to address Cow Creek's Final Restoration Plan Action 3.

Calaveras River – The final report for the Lower Calaveras River Chinook Salmon and Steelhead Limiting Factors Analysis was completed and will be available on the AFRP website. This project, working with the Fishery Foundation of California, was conducted to fill existing information gaps to assist in managing the Calaveras River to support anadromous salmonid populations. In particular, this project quantified flows required to pass fish upstream of

current barriers. A hydrologic model of the system was developed to assist with future flow recommendations and identify the required flows needed for successful immigration and out-migration of Chinook salmon and steelhead. This analysis was designed to provide additional information by evaluating various channel bed and substrate configurations occurring in the migration corridor and to quantify the amount of flow required to provide upstream passage in the Old Calaveras River channel and Mormon Slough/Diverting Canal from tidewater to Bellota Weir. Fish passage of adult and juvenile salmonids at existing diversion dams and barriers (Action 3) and evaluating instream flow (Evaluation 2) are activities in the Final Restoration Plan that are currently being addressed by this project.

Objective 4: Collect fish population, health and habitat data to facilitate evaluation of restoration actions

Bear, Cottonwood, and Cow creeks – The video weir monitoring project for Bear, Cottonwood, and Cow creeks was a cooperative project funded by AFRP and the Sport Fish Restoration Act. The work was completed through a cooperative effort of FWS, DFG, Western Shasta Resource Conservation District, and the Cottonwood Creek Watershed Group. Although 2007 was a record low fall-run Chinook escapement year, the information provided by these efforts was scientifically valid and economically efficient. Continued monitoring at these sites will be beneficial to guide AFRP restoration efforts. In addition, the information is valuable for DFG's Grandtab of Central Valley total Chinook returns. The final reports for all three creeks are available on the AFRP website.

Mill Creek – Determining escapement in Mill Creek requires an ability to accurately count adult spring-run Chinook salmon during the spring high flow season, in turbid waters and without handling the fish or potentially impeding upstream migration using weirs or traps. To address these sampling conditions, a fixed-location hydroacoustic array using split-beam (DTx) and a Dual-frequency Identification Sonar (DIDSON) was chosen for evaluation. The AFRP provided FY 2007 funding to implement a second year of a pilot study to assess the feasibility of counting adult Chinook salmon escapement in Mill Creek using fixed-location hydroacoustic techniques. Sampling occurred between April 15, 2008, and June 27, 2008. The final report for this project is forthcoming.

Yuba River – On the Yuba River a baseline hydrologic, geomorphic, and ecologic research project was conducted between Englebright Dam and the Highway 20 bridge in support of management of anadromous fish populations (Final Restoration Plan Evaluation 4). Much of this work involved ongoing analyses of 2D models. A completely new activity conducted in FY 2008 was an experimental gravel injection at Englebright Dam. Grain size measurements were made of pre-existing angular gravel and gravel-sized shotrock in this reach. However, no significant flows occurred on the river this winter; so, limited gravel fate monitoring took place in FY 2008. Also, at the Garcia Gravel Pit reference site an effort was made to locate any painted or magnetized tracer stones placed before the 2006 New Years flood, but none were found. The final report is available on the AFRP website.

A peer-reviewed journal article was also published in the journal Geomorphology- Moir, H. J. and Pasternack, G. B. 2008. Relationships between mesoscale morphological units, stream hydraulics, and Chinook salmon (Oncorhynchus tshawytscha) spawning habitat on the Lower Yuba River, California. Geomorphology. doi:10.1016/j.geomorph.2008.02.001. Also, a journal manuscript evaluating the "elasticity" of salmon selection of substrates at this site as a function of local flow velocity was written and submitted to the Canadian Journal of Fisheries and Aquatic Sciences for peer review. The manuscript focuses on a comparison of substrate availability with utilization and shows that salmon actually spawn on the Yuba River in a wider range of substrates than previously thought, depending on the local velocity. Three additional journal manuscripts or reports about the hydrogeomorphic response of different sites in the Yuba River to the May 2005 flood and 2006 New Years flood were drafted, and a manuscript also was drafted on the role of valley width in controlling riffle location and persistence over the last century.

A topographic/bathymetric map of the Englebright Dam reach was also developed. This map will be valuable for evaluating the fate of gravel injected at the base of the dam. A map of the geomorphic units throughout Timbuctoo Bend was made, and photographic images of Parks Bar obtained from a blimp were compiled to produce a mosaic image of the glide-riffle-island-chute complex, including locations of salmon redds. All these activities were part of the SHIRA-based

river analysis and field based manipulative sediment transport experiments for the Lower Yuba River and funded entirely with FY 2003-FY 2007 AFRP funds at a total project cost of $299,998. Partners for this project include Pacific Gas & Electric (PG&E), Yuba County Water Agency, UC Davis, South Yuba River Citizens League, DFG, United States Army Corp of Engineers (USCOE), and NMFS.

Two VAKI Riverwatcher fish counting systems that were installed in 2005 continued operation in 2008 and were used to count the number of fish passing upstream of the North and South fish ladders at the Daguerre Point Dam as a demonstration project. This data was collected to better understand the timing, abundance, population trends, and response to changing flow and temperature conditions of adult spring and fall-run Chinook salmon, and Central Valley steelhead in the Lower Yuba River (Final Restoration Plan Action 7). This information will help improve management of these species in the Lower Yuba River, including actions such as salmonid habitat restoration projects and providing appropriate in-stream flow regimes. AFRP purchased these monitoring systems in FY 2005; the California Department of Fish and Game operates them with oversight by the South Yuba River Citizens League.

Calaveras River – Data was collected on steelhead and fall-run Chinook salmon passage and stranding to provide information to improve flow management and inform prioritization and evaluation of passage impediments. These assessments were done in partnership with the Fishery Foundation of California and address the Final Restoration Plan Action 3 and Evaluation 2 for this watershed.

Stanislaus River – FY 2008 accomplishments included the collection of both juvenile and adult passage data via rotary screw trapping (juveniles) and a fish counting weir (adults) operated in partnership with Tri-Dam (Final Restoration Plan Action 1). The rotary screw trapping was funded with FY 2007 (b)(16) CAMP and (b)(2) Dedicated Project Yield funds. These studies assist with evaluating benefits resulting from habitat restoration actions, and summary reports are available in the AFRP website.

Merced River – Rotary screw trapping to track juvenile salmonid outmigration was conducted in FY 2008. The data will be used to assist in evaluating the benefits of habitat restoration actions. The project used FY 2007 CAMP funds and FWS staff to offset a budget shortfall that would have prevented the project from occurring. A summary report for this activity is available on the AFRP website.

Objective 5: Integrate habitat restoration efforts with harvest and hatchery management

Mokelumne River – Conducted analyses of fall-run Chinook salmon otoliths to determine the ratio of hatchery to wild fish. Data will be used to develop new methodologies that can measure hatchery contribution and derive more accurate estimates of natural production. The pilot study was funded with FY 2007 funds and will conclude in 2009.

Objective 6: Involve partners in the implementation and evaluation of restoration actions

The AFRP continued to work extensively with partners to develop and implement restoration projects. AFRP works closely with local landowners, watershed groups, agencies, professional societies, and other interested parties to share restoration and anadromous fish expertise, leverage resources, and represent program goals at public and technical meetings. For example, AFRP worked with the Fishery Foundation of California to form various diverse partnerships with multiple stakeholders that are interested in improving salmonid habitat and fish passage in the Cosumnes and Lower Calaveras rivers. AFRP is also collaborating with the Friends of the Tuolumne to restore floodplain and riparian habitats in the Tuolumne River. These efforts can potentially leverage about $4 million in additional funding that can be used to address restoration activities in these watersheds. Since 2001, AFRP has been successful in leveraging more than $12 million in the Yuba River, $4.8 million in the Merced River, and more than $9.8 million in the Tuolumne River through various funding sources such as CALFED ERP, DWR 4-Pumps, Tuolumne Irrigation District (ID), Merced ID, Yuba County Water Agency, and NRCS for anadromous fish restoration activities. These are just some examples of the many partners and programs AFRP collaborates with in many of its restoration projects.

Natural Production Doubling

In addition to assessing progress by implementing the Restoration Plan actions and evaluations, progress toward achieving the doubling goals can be assessed by calculating the production of naturally spawning fish. Although AFRP has production goals for all

anadromous fish, the program's restoration actions and evaluations have focused on Chinook salmon, as, in general, AFRP restoration activities benefit all anadromous fish. Table 2 summarizes the status of Central Valley-wide natural production of Chinook salmon, steelhead, and sturgeon in relation to the doubling goals and the baseline period. Reporting on PART, the average natural production of Central Valley-wide Chinook salmon in the doubling period (1992-2007) is currently 477,337 and below the 2009 target of 625,000 total anadromous fish. These numbers are the most recent numbers that have been through the QA/QC process from the DFG Grand Tab. Updates and revisions are posted throughout the year on the AFRP website. The natural production average has been decreasing in the last couple of years due to low adult escapement estimates in 2006 and 2007 resulting from poor ocean returns.

The Final Restoration Plan also provides doubling goals for specific rivers and creeks. Doubling production by implementing a reasonable set of actions (i.e., a subset of the Working Paper actions) is less certain than if all the actions were implemented; however, AFRP has been able to make progress towards doubling production of some Chinook salmon runs on some streams. As an example, substantial gains to date are seen in watersheds where sufficient investment has been made in flow and passage (Butte and Clear creeks) and habitat restoration (Clear Creek). Average Chinook salmon production for the period of 1992-2007 has exceeded the doubling goal target on Battle, Butte, and Clear creeks, and has been met on the Mokelumne River, as seen in Table 3.

In order to more accurately assess natural production, AFRP is demonstrating new escapement counting technologies, Alaskan weir (Stanislaus River), Vaki-infra-red counting systems (Stanislaus and Yuba rivers), video weir monitoring (Bear, Cottonwood, and Cow creeks), and hydroacoustics (Mill Creek). The AFRP is also supporting a study which should better define the percentage of hatchery-origin fish in escapement by looking at sulfur isotope (S32:S34) ratios in otoliths taken from natural spawning Chinook salmon from the Mokelumne River and comparing these to ratios observed in hatchery produced stocks. This information will provide methods to derive more accurate estimates of natural production.

Table 2. AFRP Fish Production Estimates in All Central Valley Streams (1992-2007)

Chinook Salmon Species and Watershed[1]	AFRP Annual Doubling Goals[2]	Average Baselines (1967-1991)[3]	Average Natural Production (1992-2007)[4]	Average % Natural Production Difference From Baseline[5]
All Chinook runs, all Central Valley streams	990,000	497,240	477,337	-4
Fall-run, all Central Valley streams	750,000	374,217	432,096	15
Winter-run, all Central Valley streams	110,000	54,417	8,086	-85
Spring-run, all Central Valley streams	68,000	34,425	16,383	-52
Late fall-run, all Central Valley streams	68,000	34,182	20,772	-39
Steelhead, all Central Valley streams	13,000	6,574	1,127	-83
Green sturgeon, all Central Valley streams	1,966	983	2,246[6]	128
White sturgeon, all Central Valley streams	11,000	5,571	5,507[6]	-1

Table 3. Chinook salmon AFRP production, in Battle, Butte and Clear creeks, and Mokelumne River (1992-2007)

Chinook Salmon Species and Watershed[1]	AFRP Annual Doubling Goals[2]	Average Baselines (1967-1991)[3]	Average Natural Production (1992-2007)[4]	Average % Natural Production Difference From Baseline[5]
Battle Creek, fall-run	10,000	5,012	20,935	318
Battle Creek, late fall-run	550	273	681	149
Butte Creek, fall-run	1,500	763	3,141	312
Butte Creek, spring-run	2,000	1,017	11,382	1,019
Clear Creek, fall-run	7,100	3,574	11,946	234
Mokelumne River, fall-run	9,300	4,679	9,079	94

[1] Only streams and rivers with complete salmon production data sets (1992-2007) are shown.

[2] Annual doubling goals were derived from "Mills, T.J. and F. Fisher. 1994. Central Valley Anadromous Sport Fish Annual Run-size, Harvest, and Population Estimates, 1967 through 1991, California Department of Fish and Game. 62pp" and published in "USFWS. 2001. Final Restoration Plan for the Anadromous Fish Restoration Program, A Plan to Increase Natural Production of Anadromous Fish in the Central Valley of California. Released as a Revised Draft on May 30, 1997, and adopted as final on January 9, 2001. CVPIA, AFRP, Stockton, CA. [http://www.delta.dfg.ca.gov/afrp/restplan_final.asp]."

[3] Baseline escapement data were derived from Mills and Fisher (1994) and used to generate natural production estimates for the doubling goal baseline period, 1967 through 1991.

[4] Grand Tab, California Department of Fish and Game. Data from this publication was used to generate natural production estimates for the doubling goal, 1952 through 1966, and the doubling period, 1992 through 2007.

[5] The percent of increased natural production over baseline for each watershed was calculated by subtracting baseline natural production (1967-1991) from natural production (1992-2007) and dividing the result by baseline natural production (1967-1991) and multiplying by 100.

[6] Data is through 2005.

Habitat Restoration Program

FY 2008

Funding Obligation

$1,346,000 (Restoration Fund)

Accomplishments

- Protected 1,787 acres of habitat
- Restored 1,908 acres of habitat
- Funded seven projects that focused on high priority species and habitats impacted by the CVP

Snake Marsh Pilot Restoration - Before (Top) and After (Bottom). The new pond replaced the existing invasive yellow water primrose in a 1-acre area.

CVPIA Section 3406(b)(1) "other"

"…in the course of developing and implementing this program the Secretary shall make all reasonable efforts consistent with the requirements of this section to address other identified adverse environmental impacts of the CVP not specifically enumerated in this section."

The Habitat Restoration Program (HRP), under section (b)(1) "other", benefits federally listed Central Valley species and their habitats that were adversely impacted by operation and construction of the CVP and are not specifically addressed in CVPIA's Fish and Wildlife Restoration section. Habitat loss and fragmentation due to urbanization and agriculture conversion occurred on an estimated 2.7 million acres as a result of CVP construction and operation (Interim Contract Renewals, February 1995).

The HRP's priority actions, considered most effective and critical to species' protection and recovery, include purchase of fee title or conservation easements on lands where threats are significant; targeted restoration of CVP-impacted habitats where actions will markedly improve conditions; research to facilitate species recovery; and public outreach, education, planning, and management. These actions support the program's output goal of contributing to restoring the 2.7 million acres impacted by the CVP construction and operation.

To help direct conservation actions into high-priority areas and assist applicants in developing competitive proposals, the HRP developed a Geographic Information System (GIS)-based "Project Area Map"

that defines the program's geographic focus area. The HRP also developed a "High Priority Species List" that defines species identified in various recovery plans (both resources are available on the HRP Web site: http://www.usbr.gov/mp/cvpcp).

High Priority Species and Habitats

To date, the HRP has allocated about $24 million to fund about 90 projects supporting the recovery of federally listed threatened and endangered species such as:

- San Joaquin kit fox
- Giant kangaroo rat
- Blunt-nosed leopard lizard
- California red-legged frog
- Giant garter snake
- Bay checkerspot butterfly
- Valley elderberry longhorn beetle
- Riparian brush rabbit
- Riparian woodrat
- Lange's metalmark butterfly
- Vernal pools species (plants and invertebrates)
- Gabbro soil plants

Figure 4 maps the HRP project locations from 1996-2008

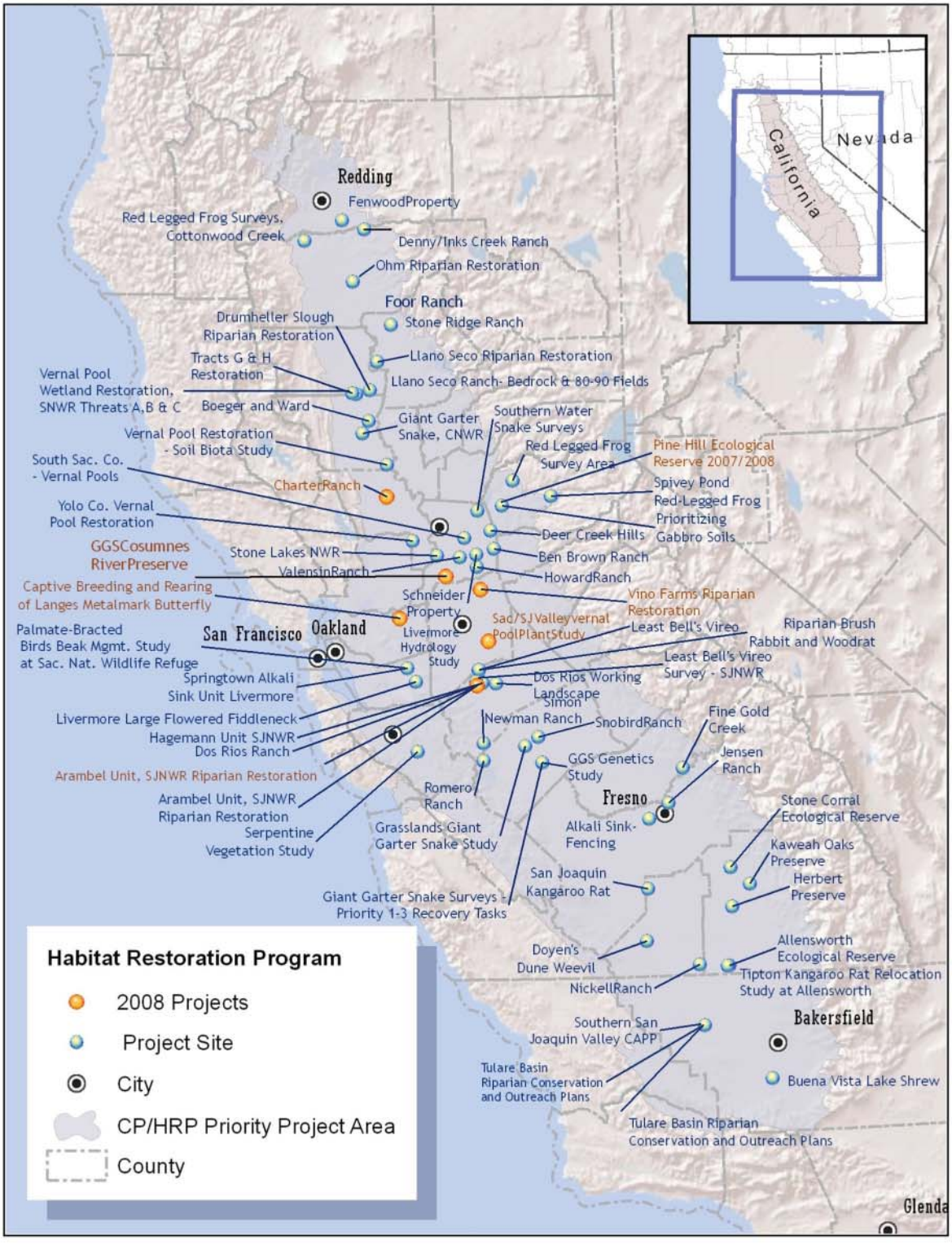
Since 1996, HRP funds have been used to acquire (protect) more than 93,000 acres and restore more than 7,300 acres, for a total of more than 100,000 acres; this contributes towards one of the HRP's performance goals. The 100,000 acres is almost 4 percent of the 2.7 million acres restoration goal to restore habitat impacted by the CVP. As shown in table 4, the bulk of the acreage was acquired in 1998 as part of the Wells Fargo (Simon Newman and Romero Ranches) project.

Acres of habitat that have been protected and restored can also be calculated based on the percentage of funding from the HRP and from contributing partners. Of the 100,000 acres, almost 11,000 acres have been

Table 4. Acres of Habitat Protected & Restored per Year (1996-2008) for the Habitat Restoration Program

Year	Total Acres of Habitat Protected and Restored for Projects that the HRP Contributed Towards with Partners		Acres of Habitat Protected and Restored Based on Percentage the HRP Contributed Towards the Total Acres	
	Habitat Protection (acres protected via fee title acquisition and conservation easements)	Habitat Restoration (acres restored)	Habitat Protection (acres protected via fee title acquisition and conservation easements)	Habitat Restoration (acres restored)
1996	3,018	0	362	0
1997	284	617	149	485
1998	74,146	0	4,399	0
1999	1,180	0	554	0
2000	1,426	206	366	78
2001	2,831	0	529	0
2002	2,211	0	122	0
2003	2,866	0	459	0
2004	719	432	129	106
2005	755	3,370	5	2,352
2006	193	731	21	364
2007	1,603	122	16	48
2008	1,787	1,908	1	446
SUBTOTAL	**93,019**	**7,386**	**7,112**	**3,879**
TOTAL	**100,405**		**10,991**	
GOAL/TARGET	**2.7 million**			

Figure 4. Habitat Restoration Program Project Locations



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Restoration Project Sites are general approximations of project locations. Some projects have multi-locations and are represented by one data point.

acquired or restored with contributions solely from the HRP (Table 4). This represents about 11 percent of funding contributed by the HRP towards important protection and restoration actions. Partners have contributed about 89 percent of the funding. By joining with partners, the HRP program is able to expand its ability to meet program goals.

Acquisition only covers the purchase of the land; further effort is required to restore the desired habitat. Habitats protected and restored include vernal pool, riparian, alkali scrub, foothill chaparral, valley-foothill hardwood and grassland (Table 5). Post-monitoring certain project sites has revealed high rates of success with restoration activities. For example, riparian vegetation at several locations (e.g., Llano Seco) has experienced an approximately 80 percent survival rate. Another example is the new pond construction downstream of known California red-legged frog populations at Spivey Pond in El Dorado County which helped expand populations of this species. The HRP partnered with the American River Conservancy and the Bureau of Land Management to help purchase Spivey Pond. The pond supports one of the few known populations of California red-legged frogs. In 2005, the HRP funded construction of a pond downstream of Spivey Pond, where occurrence of the species has recently been recorded.

California Red-legged Frog – A Species that has Benefitted from Restoring Spivey Pond

Since 1996, 67 surveys and studies and 12 planning, management, and outreach actions have been funded by the HRP. These actions also contribute to the overall goal of species recovery.

Measuring Success

In fiscal year 2008, HRP funds ($1,346,000) were used to fund a balanced set of actions that focused on high-priority species and habitats impacted by the CVP (Table 5). Progress reports are available for all projects and may be requested from the HRP program managers. Table 5 summarizes the FY 2008 projects.

Acquiring and Restoring Red-Legged Frog Habitat at Spivey Pond - Before (Top) and After (Bottom)

Table 5. FY 2008 Projects Funded by the Habitat Restoration Program

Project	Status	Significance
National Audubon Society - Fee title acquisition of 1,787-acres of Charter Ranch in Yolo County, and development of Best Management Practices for managing 587acres of rice land for listed species, shorebirds, and waterfowl. HRP funded $258,220.	**On-going** Property appraisal approved by DOI in October 2008. Audubon in continued negotiations with landowner. Acquisition will result in permanent protection of giant garter snake habitat in the Central Valley.	Supports species and habitat protection: Charter Ranch is contiguous with other restored wetland, riparian, and upland habitats, and provides the opportunity to protect and restore lands for listed species including valley elderberry longhorn beetle, giant garter snake, and Swainson's hawk.
River Partners - Riparian habitat restoration for endangered species on 223 acres at the Arambel Unit of the San Joaquin River NWR in Stanislaus County. Restoration of high quality riparian habitat will occur over a 3-year period. HRP funded $200,000.	**On-going** Restoration plan approved in October 2008. Site preparation and planting begun on field A-1. Cultural resources survey needed on field A-2; restoration activities to begin in spring 2009. Restoration to be completed by spring 2010.	Supports species and habitat protection: Restoration will continue efforts already begun at the site, and provide benefits for several listed species, including riparian brush rabbit, riparian woodrat, least Bell's vireo, and valley elderberry longhorn beetle, as well as dozens of other species as the site matures.
Service, Sacramento Field Office - Restoration of 22.5 acres of riparian habitat for special status species at Vino Farms along 0.6 mile of the lower Mokelumne River in San Joaquin County. HRP funded $186,114.	**On-going** Interagency agreement signed in September 2008. Landowner coordination complete; preliminary site preparation to begin in October/ November 2008. Restoration to be completed by spring 2010.	Supports species and habitat protection: The Mokelumne River watershed is under threat of losing its remaining native riparian habitats to vineyards, orchards and other agricultural uses and residential development. This project will benefit riparian-dependent species including valley elderberry longhorn beetle, least Bell's vireo, western yellow-billed cuckoo, willow flycatcher, and Swainson's hawk.
Bureau of Land Management (BLM) - Fuels Management at the Cameron Park Unit of the Pine Hill Preserve will decrease the number, size, and intensity of wildfires at the 454-acre Cameron Park Unit of the Pine Hill Preserve in El Dorado County, which will improve habitat for seven rare plant species. HRP funded $70,000.	**On-going** Under three different contractors, BLM has removed shrubs and trimmed trees in about 6 acres along the urban-wildland-interface at the Cameron Park unit of the Pine Hill Preserve. The six acres include five different sites where fuels have been reduced along more than 0.5 mile of the Preserve boundaries and up to 100 feet into Preserve lands. BLM will continue to improve habitat for rare plants; monitor response of habitat and rare plants; implement fuels load reduction techniques; provide fire defensible space around structures adjacent to the Preserve; and prepare and submit Progress Reports, Draft Report, and a Final Report to the HRP (due 2010).	Supports species and habitat protection: The project will improve habitat for seven rare plant species (Stebbin's morning glory, Pine Hill ceanothus, El Dorado bedstraw, Layne's butterweed, El Dorado mule-ears, Bisbee-Peak rush-rose, and Red Hills soaproot); contribute to the safety of Cameron Park and Shingle Springs communities by providing defensible space around structures adjacent to the Preserve; and set up a program to monitor fuels reduction effects on rare plants by developing a Monitoring Plan.

Table 5. FY 2008 Projects Funded by the Habitat Restoration Program (Continued)

Project	Status	Significance
Service, Antioch Dunes NWR - Continuation of captive propagation of the Lange's metalmark butterfly at Moorpark College in the Exotic Animal Training and Management Program facility, and continuation of restoration of dune habitat for the butterfly, Contra Costa wallflower, and Antioch Dunes evening primrose at Antioch Dunes NWR in Contra Costa County. HRP funded $112,069.	**On-going** Captive propagation is going very well. Over 115 adult butterflies were counted at Antioch Dunes NWR in 2008. Additionally, more than 8 acres of dunes habitat have been cleared and planted with native buckwheat. The NWR submitted another proposal to the HRP for FY 2009 to continue funding the propagation and restoration activities. Funding decisions were made in April 2009.	Supports habitat and species protection: The Lange's metalmark butterfly is on the verge of extinction and is found only at Antioch Dunes NWR; restoration of dunes habitat will enhance native buckwheat host plant survivability and recovery of the wallflower and primrose, two federally endangered species.
Carol Witham, Sole Proprietor Consultant - Status surveys for seven federally listed vernal pool grasses and Chamaesyce hooveri (Hoover's spurge) in the Sacramento and San Joaquin Valleys. The last comprehensive survey for these species was conducted in 1986-1987. These new surveys will contribute towards determining the current status of all California Natural Diversity Database (CNDDB) occurrences in the Central Valley for these important species. HRP funded $147,800.	**On-going** The consultant began work on the project in 2008. Data was collected at two sites in Sacramento County, which helped test the methodology to be used, especially the data dictionary for the Global Positioning System (GPS). The dictionary was revised to make the data entry order more logical, based upon the sequence of field steps that are most efficient. The consultant is continuing to work on the GIS database; aerial photography analysis of presumed extirpated sites; and landowner contacts and access issues. Field work may need to be delayed if drought continues.	Supports species and habitat protection: Project is urgent in terms of gathering information in order to make better-informed decisions related to prioritizing recovery actions for the species. The project specifically targets eight listed plant species: Hoover's spurge, Colusa grass, SJ Valley orcutt grass, Hairy orcutt grass, Slender orcutt grass, Sacramento orcutt grass, Greene's tuctoria, and Solano grass.
Bureau of Land Management, Folsom Field Office – Research and restoration of priority wetlands for giant garter snake at Snake Marsh located at the Cosumnes River Preserve in Sacramento County. This project will contribute towards determining how rapidly changing hydrology and invasive water primrose on and adjacent to the Cosumnes River Preserve are impacting the giant garter snake population located on the Badger Creek sub-unit of the Preserve. HRP funded $142,225.	**On-going** Project tasks have begun. Traps were placed to determine baseline giant garter snake presence, distribution, and relative density prior to and after conducting the pilot restoration project. A 1-acre pond was excavated to create open-water habitat for the giant garter snake. Excavated material (invasive water primrose and soil) was dumped within a designated stockpiling area, leveled, and contoured to create a new 1-2-acre high-ground area that could eventually be used by burrowing rodents, thereby creating additional aestivation and, possibly, over-wintering habitat for the giant garter snake. Giant garter snakes will continue to be monitored during the 2009 active season to evaluate the species' immediate response to the pilot restoration effort, and formulate a long-term management strategy for the marsh.	Supports species and habitat protection: The project is urgent because the Snake Marsh population represents the most genetically distinct population of giant garter snakes known to date. A significant portion of Snake Marsh goes completely dry in summer as a result of the primrose and altered hydrology of the marsh and creek. It is anticipated that if primrose continues to grow and expand into the last remaining limits of Snake Marsh and Badger Creek, the habitat will no longer support the snake or prey species for the snake, and thus cause the likelihood of localized extinction.

Trinity River Restoration Program

FY 2008

Funding Obligation

$1,647,000 - 3406(b)(1) "other" - (Restoration Fund)

$5,176,000 - 3406(b)(1) "other" - (Water & Related)

$3,000 - 3406(b)(23) - (Restoration Fund)

$1,685,000 - 3406(b)(23) - (Water & Related)

Accomplishments

- Released flows of 647,000 acre-feet
- Completed construction of eight channel rehabilitation sites associated with the Lewiston-Dark Gulch Site Rehabilitation Project
- Placed 14,300 cubic yards of gravel: 12,000 cubic yards in the mainstem of the Trinity River and 2,300 cubic yards directly injected to the river by mechanical conveyor
- Completed or initiated nine priority watershed projects that prevented between 30,000 and 60,000 cubic yards of sediment from being produced in upland source areas and its potential delivery to the Trinity River

Conveyer Gravel Injection in Lewiston during the May 2008 High Flow Event

CVPIA Section 3406(b)(1) "other" and 3406(b)(23)

"…That in the course of developing and implementing this program the Secretary shall make all reasonable efforts consistent with the requirements of this section to address other identified adverse environmental impacts of the Central Valley Project not specifically enumerated in this section"; and

"In order to meet Federal trust responsibilities to protect the fishery resources of the Hoopa Valley Tribe, and to meet the fishery restoration goals of the Act of October 24, 1984, Pub. L. 98-541, provide through the Trinity River Division, for water years 1992 through 1996, an instream release of water to the Trinity River of not less than 340,000 acre-feet per year for the purposes of fishery restoration, propagation, and maintenance…"

The completion of the Trinity and Lewiston Dams in 1964 allowed water from the Trinity River to be diverted to the Sacramento River and California's Central Valley for power generation and irrigation purposes. The dams barred salmonids from more than 100 miles of upstream habitat, and deteriorated downstream spawning and rearing habitat by reducing the magnitude and variability of water flows. By the 1990s, salmonid production in the Trinity River had dropped by more than 80 percent.

The Trinity River Restoration Program (TRRP) is dedicated to the improvement of anadromous fisheries habitat in the Trinity River Basin. The program uses

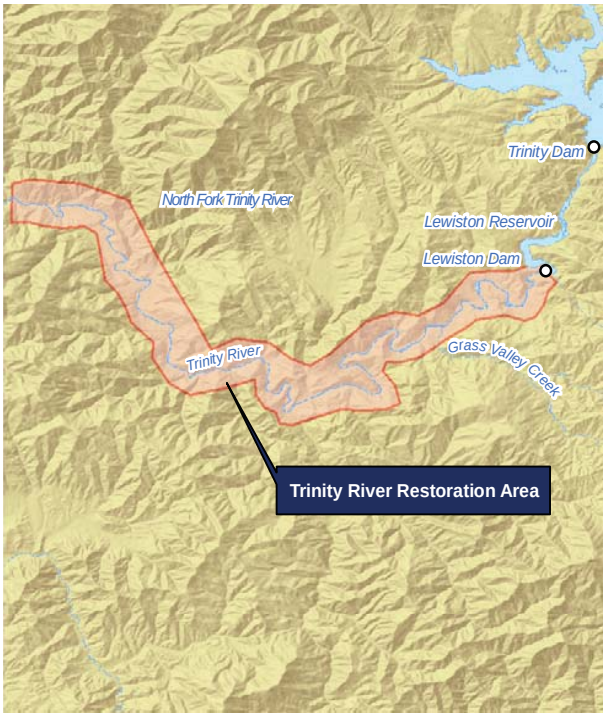


Figure 5. Trinity River Restoration Program Map

two authorities: CVPIA section 3406 (b)(1) "other" for river restoration and CVPIA section 3406 (b)(23) for delivering flows.

The Trinity River Mainstem Fishery Restoration Environmental Impact Report/Environmental Impact Statement (EIR/EIS) and its accompanying Record of Decision (ROD) were completed and signed by the Secretary of the Interior, with concurrence of the Hoopa Valley Tribe, in December 2000. The ROD identified a series of restoration actions, including a monitoring and assessment program, to make program adjustments as required. Since 2001, the TRRP has been implementing these restoration activities, focusing on the upper 40 miles of the Trinity River between Lewiston Dam and the confluence with the North Fork of the Trinity River.

Since 2001, the CVPIA Restoration Fund has allocated $11.1 million to the TRRP. The program has implemented 16 of the 47 target mechanical channel rehabilitation projects and all of the infrastructure improvements necessary to allow the program to regularly achieve annual flow release goals, including dam releases, of up to 11,000 cfs in an extremely wet year. Significant accomplishments made by TRRP include:

- Construction of 16 channel rehabilitation projects (Hocker Flat, four sites near Canyon Creek, three sites near Indian Creek, and eight sites in the Lewiston area)
- Construction of three replacement bridges and upgrade of an approach road/culvert allowing full implementation of the ROD flow regime
- Completion of a comprehensive inventory of floodplain structures for more than 500 privately owned parcels
- Improvement of 1.5 miles of road accessing private homes
- Relocation of one house and modification of more than 25 other smaller structures
- Renovation of 78 domestic water or sewer systems
- Processing environmental documentation, regulatory permits, and engineering designs to allow a construction contract award for up to eight additional channel rehabilitation projects in 2009 and 2010

Reclamation and TRRP partners have implemented full ROD flows since 2005, following successful resolution of litigation that initially constrained ROD flows in 2001-2004. Water year types since 2005 have included Extremely Wet, Dry, and Normal with volumes ranging from 453,000 acre-feet to 815,000 acre-feet. Full implementation of ROD releases are now possible based on water year type. Approximately 1.8 million acre-feet more water has been released to the river over the past eight years than would have occurred without the ROD.

Working in partnership with Native American tribes, other federal agencies, the State of California, Trinity County, and a broad cross-section of stakeholders, Reclamation plans and implements restoration activities and adaptively manages the program based on information generated by monitoring and evaluation. Enabling legislation (PL 98-541, as amended) established a series of goals to achieve and maintain healthy, stable fisheries populations. A combination of outcome-based goals and output-based goals were developed to measure the progress of the program.

The outcome-based goal is indicated by natural and hatchery-produced adult spawner escapement to the Trinity River, as indicated in Table 6. The 1983 EIS for the Trinity River Basin Fish and Wildlife Management Program documented the in-river spawner escapement goals and the Trinity River Salmon and Steelhead Hatchery production goals developed by DFG. The goals were subsequently adopted by the TRRP as escapement numbers. The in-river goals represent the

Table 6. Annual Target Escapement, Trinity River

Target Trinity River Natural Adult Spawner Escapement	Target Trinity River Hatchery-Produced Adult Spawner Escapement
62,000 fall-run Chinook salmon	9,000 fall-run Chinook salmon
6,000 spring-run Chinook salmon	3,000 spring-run Chinook salmon
40,000 steelhead	10,000 steelhead
1,400 coho	2,100 coho

total number of naturally produced adult spawners for the Trinity River Basin below Lewiston Dam and exclude fish caught by the fisheries.

The output-based goals are indicated by four criteria:

Increasing minimum flow releases – Measured by annual acre-feet of instream flow releases to meet tribal trust responsibilities and fishery restoration goals; the target flow release is between 369,000 and 815,000 acre-feet per year (varies by water year type), with potential peak flows to 11,000 cfs by 2008 and annually thereafter.

Implementing construction projects – Measured by progress toward completion of 47 mechanical channel rehabilitation projects and all necessary infrastructure improvements. The channel rehabilitation target is to complete 24 channel rehabilitation projects by the end of 2008, with the remainder by 2012. The infrastructure improvements target is to complete the infrastructure improvements to allow fishery flow releases of up to 11,000 cfs by 2008.

Coarse sediment management – Goals for coarse sediment management are to increase the total quantity of coarse sediment stored in the Trinity River, and to reduce bed surface grain sizes to facilitate bed mobility and salmonid spawning. Progress toward these goals is assessed by measuring coarse sediment transport through a bedload sampling program, documenting the quantities of coarse sediment added to the river through rehabilitation site construction and gravel augmentation, and mapping of bed sediment characteristics. Specific targets are to place 7,000 cubic yards of gravel in the upper river per year, to verify that gravel augmentation volumes equal or exceed the flux of gravel transported out of the upper river, and to reduce reach-averaged median bed surface grain sizes to approximately 3-inch diameter particles.

Watershed restoration – Watershed restoration and associated activities are intended to reduce the quantity of fine sediment (particles less than about 1/4 inch in diameter) in the Trinity River by reducing fine sediment production and delivery from tributary watersheds, and by increasing fine sediment transport rates in the Trinity River. Quantitative targets include achieving a long-term reduction in the total quantity of fine sediment stored in the Trinity River between Lewiston Dam and the North Fork Trinity River by at least 250,000 cubic yards, to reduce fine sediment delivery to the upper river by 10,000 to 20,000 cubic yards per year, and to annually transport as much or more fine sediment downstream as is delivered to the upper river from tributary watersheds.

Measuring Success

Outcome-based Target – Escapement Increases

Monitoring suggests there has generally been an improvement in health and vigor of outmigrating juveniles, as well as returning adult spawners of all species since 2000. Data suggest an upward trend in coho salmon and steelhead run size over the last 12 years, along with decreased prevalence of disease and improved egg/sperm viability of spawners of all species.

The DFG responded to increases in 2006 and 2007 record fish runs in steelhead numbers by instituting a larger take limit for hatchery steelhead for recreational anglers in the Trinity River during the 2008 fishing season. While much of the increased population consists of hatchery-produced fish, this suggests a response to system-wide improvements in temperatures and reduced fine sediment that likely is beneficial to all species and runs. The variable nature of these populations is demonstrated in preliminary 2008 weir counts, which

suggests a smaller steelhead run than the past two years, but with a somewhat higher percentage of wild fish.

Output-based Targets

Increasing Minimum Flow Releases

Water Year 2008 was classified as a normal water year in accordance with the ROD resulting in 647,000 acre-feet being released from the Lewiston Reservoir, which met the target flow release of between 369,000 and 815,000 acre-feet per year.

Implementing Construction Projects

In FY 2008, the program completed construction of eight channel rehabilitation sites covering a project area of three miles in length associated with the Lewiston-Dark Gulch Site Rehabilitation Project. This will provide increased geomorphic and hydraulic complexity to this high priority area of the river and provide greater diversity of fish habitats, supporting a wide range of life stages. Completion of these eight sites in 2008 brings the total number of mechanical channel rehabilitation projects to 16, which is eight sites short of the goal of completing 24 sites by 2008. In addition, the TRRP has only enough funding to complete two sites in 2009, which will make it difficult to meet the goal of constructing 47 sites by 2012.

Coarse Sediment Management

In 2008, the program placed a total of 12,000 cubic yards of gravel in the mainstem of the Trinity River as part of the Lewiston-Dark Gulch channel rehabilitation construction contract to improve spawning and rearing habitat, as well as facilitate the creation of needed geomorphic features farther downstream. An additional 2,300 cubic yards was directly injected to the river by mechanical conveyor during peak fishery restoration flows in May 2008. In total, the program placed about 14,300 cubic yards of coarse sediment in the river during 2008, doubling the annual target of 7,000 cubic yards. This quantity greatly exceeded the quantity of coarse sediment transport transported out of the upper river in 2008, which is estimated at approximately 520 cubic yards.

The program has made substantial progress toward restoring the total quantity of coarse sediment stored in the upper river to pre-dam levels. A total of more than

Constructed Gravel Bars in the Lewiston-Dark Gulch Project - Before (Top) and After (Bottom)

54,400 cubic yards of coarse sediment has been added to the upper river since dam closure, with about 22,300 cubic yards of that total being placed since 2003. A current update of sediment budgets previously computed through WY 2000 that incorporates recent augmentation quantities and recent estimates of the coarse sediment loads transported downstream suggests that the total quantity of coarse sediment stored in the upper river is within about 7,000 cubic yards of pre-dam levels.

Watershed Restoration

In 2008, TRRP completed or initiated nine priority watershed projects, and leveraged more than $300,000 in matching funds for watershed implementation. Projects under construction in 2008 were road upgrades in the Indian Creek, Browns Mountain, Little Browns Creek, and Union Hill areas, revegetation/soil stabilization projects in Grub Gulch and the Oregon/Junction Fire area, landowner outreach for mitigation in the Lowden Fire area, a culvert replacement in Union Gulch, and excavation of a sediment detention basin at Dark Gulch.

These projects prevented between 30,000 and 60,000 cubic yards of sediment from being produced in upland source areas and its potential delivery to the Trinity River. Ten additional projects were identified and funded for implementation in 2009. Also in 2008, about 10,000 cubic yards of fine sediment was transported downstream past the sediment transport sampling location near Douglas City.

Constructed side channel from the Indian Creek project in October 2007 (Top) and June 2008 (Bottom)

Modified CVP Operations

FY 2008

Funding Obligation

$509,000 (Restoration Fund)

Accomplishments

- Reoperated the system multiple times to provide benefits to anadromous fish on Clear Creek
- Completed draft reports for spring- and fall-run Chinook salmon and steelhead fry and juvenile rearing and redd dewatering and juvenile chinook and steelhead stranding on the Yuba River
- Completed monitoring for fall-run Chinook salmon and steelhead spawning on Clear Creek
- Completed final report for floodplain inundation on the Tuolumne River

CVPIA Section 3406(b)(1)(B)

"As needed to achieve the goals of this program, the Secretary is authorized and directed to modify CVP operations to provide flows of suitable quality, quantity, and timing to protect all life stages of anadromous fish, except that such flows shall be provided from the quantity of water dedicated to fish, wildlife, and habitat restoration purposes under paragraph (2) of this subsection; from the water supplies acquired pursuant to paragraph (3) of this subsection; and from other sources which do not conflict with the fulfillment of the Secretary's remaining contractual obligations to provide CVP water for other authorized purposes. Instream flow needs for all Central Valley Project controlled streams and rivers shall be determined by the Secretary based on recommendations of the U.S. Fish and Wildlife Service after consultation with the California Department of Fish and Game."

The flow of water in rivers and streams is essential for all fish life stages: spawning, fry emergence, juvenile development, outmigration, and passage back to spawning grounds. Flows help maintain a healthy environment for fisheries by maintaining sufficient stream depth and optimal temperatures for spawning and rearing. Periods of high flow also move sediments downstream that establish and maintain the river bottom. Reclamation and the Service are dedicated to creating optimal flows to increase anadromous fish populations consistent with the doubling goal.

Interior modifies base condition CVP operations using (b)(2) water, (b)(3) water, and by "reoperating" the system to provide instream benefits to anadromous

fish. Reoperating the system is done by changing and coordinating planned releases between CVP dams when doing so improves instream conditions without impacting other CVP obligations or authorized purposes.

Determining the instream flow needs in CVP streams is an ongoing process that is being addressed in part by the Instream Flow Requirements Program, which provides scientific information to the CVPIA program to assist in developing recommendations for instream flow needs for anadromous fish in Central Valley streams. The Instream Flow Incremental Methodology (IFIM) is a habitat-based model developed by the Service to assess instream flow needs for aquatic resources, including anadromous fish. The program goal is to provide up to nine specified instream flow studies, although no time period is specified for this goal. Studies funded under section (b)(1)(B) focus on CVP streams (Sacramento, American, and Stanislaus rivers and Clear Creek). Studies funded under section (b)(1) focus on all other Central Valley streams. Generally there is an IFIM modeling project for each life stage of anadromous fish within each segment of the Sacramento, American, Merced and Yuba rivers and Clear and Butte creeks.

The Service uses the IFIM program to demonstrate the effect of varying flows of water within specific watersheds. The information developed by IFIM are used by (b)(2) program managers in developing recommendations for instream flow in CVP streams and by other Service program managers for other Central Valley streams.

The IFIM process follows four basic steps:

1) Monitoring, consisting of data collection
2 Modeling, consisting of analysis
3) Peer Review by U.S. Geological Survey (USGS), CALFED, consultants or academics
4) Production of a final report

Since 1995, IFIM studies have been completed for the Sacramento, American, and Merced rivers and Butte Creek; the data generated by these studies have been used by the Service to negotiate flow changes that have a dramatic effect on fish production. For instance, the Butte Creek IFIM study showed that increasing water flows from 40 to 120 cfs during the fall season would increase the amount of spawning habitat for spring-run Chinook salmon by a significant 72 percent. Based on these data, the Service's Energy and Instream Flow branch negotiated changes to annual operating plans that resulted in an increase in fall flows to 60 cfs in 2004 and 2007 and 75 cfs in 2005 and 2006. These flows were agreed to between resource agencies and PG&E during development of the annual operating plan. Establishing these flow-habitat relationships was critical to the development of the annual operating plan for Butte Creek.

Based on these data, in FY 2008 the Service recommended that the Federal Energy Regulatory Commission (FERC) consider new terms for Butte Creek between the Centerville Dam and Powerhouse that would allow the full 120 cfs flow in Butte Creek from September 1 to March 15- a critical period covering the spawning and emergence of fry.

Collecting IFIM Field Data in Clear Creek

Another example of the use of IFIM data is the Sacramento River IFIM study (2006) which demonstrated that substantial juvenile stranding and redd dewatering could be avoided by keeping flows above 3,750 cfs. "Stranding" is a term used to describe fish that are trapped in pools of water that have no connectivity to the larger stream because of insufficient flow. Similarly, redd dewatering occurs when redds (fish egg "nests") are left exposed by receding water levels. In 2008, the data from this IFIM study were used to justify operational changes in the allocation of (b)(2) water in

the Sacramento River and flows were maintained above the 3,750 cfs level to minimize juvenile stranding and redd dewatering.

As noted above, the Service has completed modeling for the Sacramento (2003, 2005), Merced (1997) and American (2003) rivers and Butte Creek (2003), generating valuable data to determine optimum flows. The Service has continued to prioritize additional rivers for IFIM modeling. Prioritization is based on a number of factors:

- Feasibility - Is there an upcoming FERC relicensing that provides a platform for change?
- T&E species - Are there threatened and endangered species that would benefit from operational changes?
- Species - How many salmonid races/species are present?
- Complications - Are other actions needed to improve passage and access to spawning grounds before operational flow changes would have an effect?

Based on these factors, from 2001 to 2008 the Service added the Yuba and Tuolumne rivers and Clear and South Cow creeks to the priority list of rivers to be modeled over the next five years.

Measuring Success

In FY 2008, the CVP reoperated the system multiple times to provide benefits to anadromous fish on Clear Creek without impacting other CVP obligations or authorized purposes. These reoperations improved conditions on Clear Creek without changing the total amount of CVP water being released.

Since 1995, the program has completed 12 IFIM studies meeting the program goal to provide up to nine IFIM studies. Table 7 illustrates progress on the studies that were active in 2008. (Dates indicate completion of an activity.)

As shown in Table 7, the major accomplishments for 2008 include the following:

Yuba River – Completion of draft report for spring- and fall-run Chinook salmon and steelhead fry and juvenile rearing and completion of draft report for redd dewatering and juvenile Chinook and steelhead stranding.

Clear Creek – Completion of monitoring for fall-run Chinook salmon and steelhead lower reach spawning.

Tuolumne River – Completion of final report for floodplain inundation as a function of flow.

Table 7. IFIM Studies Active as of 2008

River	IFIM Modeling Project	Monitoring	Modeling	Peer Review	Final Report
Yuba	Spring and fall-run Chinook salmon and steelhead fry and juvenile rearing	FY 2007	**FY 2008**	FY 2009	Expected FY 2009
	Redd dewatering and juvenile Chinook and steelhead stranding	FY 2007	**FY 2008**	FY 2009	Expected FY 2009
	Spring- and fall-run Chinook salmon and steelhead spawning	FY 2004	FY 2006	FY2006	Expected FY 2009
Clear Creek	Spring-run Chinook salmon and steelhead upper reach spawning	FY 2005	FY 2006	FY 2007	FY 2007
	Fall-run Chinook salmon and steelhead lower reach spawning	**FY 2008**	FY 2009	Expected FY 2009-10	Expected FY 2009-10
	Juvenile spring-run Chinook salmon and steelhead upper reach rearing	FY 2007	FY 2009	Expected FY 2009-10	Expected FY 2009-10
	Juvenile spring-run and fall-run Chinook salmon and steelhead lower reach rearing	FY 2009	FY 2009	Expected FY 2009-10	Expected FY 2009-10
Tuolumne	Floodplain inundation as a function of flow (La Grange Dam to river mile 22)	N/A	FY 2007	**FY 2008**	**FY 2008**

Dedicated 800,000 acre-feet Project Yield

FY 2008

Funding Obligation

$817,000 (Restoration Fund)

Accomplishments

- Managed 600,000 acre-feet of CVP (b)(2) water for fish, wildlife and habitat restoration purposes
- Augmented low base flows on the American River, Sacramento River, Stanislaus River, and Clear Creek
- Assisted in meeting WQCP requirements with water from the Sacramento, American, and Stanislaus rivers
- Used (b)(2) water in conjunction with acquired (b)(3) water to provide pulse flows for adult Chinook migration and spawning and juvenile salmonid outmigration on the Stanislaus River
- Curtailed exports to assist in meeting WQCP delta requirements, to comply with Interim Remedial order (delta smelt entrainment concerns), and to meet VAMP export target

CVPIA Section 3406 (b)(2)

"…dedicate and manage annually 800,000 acre-feet of Central Valley Project yield for the primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized by this title; to assist the State of California in its efforts to protect the waters of the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; and to help meet such obligations as may be legally imposed upon the Central Valley Project under state or federal law following the date of enactment of this title, including but not limited to additional obligations under the federal Endangered Species Act…"

Interior has the responsibility to annually dedicate and manage 800,000 acre-feet of CVP (b)(2) water for fish, wildlife, and habitat restoration purposes. This water is accounted as CVP releases and decreased CVP export pumping, relative to a hypothetical pre-CVPIA baseline operation. The accounting specifically looks at changes in operations on the American River (Nimbus Dam), Sacramento River (Keswick Dam), Stanislaus River (Goodwin Dam), Clear Creek (Whiskeytown Dam) and the delta pumps (see Figure 6 for location map).

In general, (b)(2) fish actions include CVP pumping reductions and CVP reservoir release increases relative to a hypothetical base case of pumping and releases the CVP would make given current demands and hydrologic conditions, but under pre-CVPIA regulatory requirements. Generally, the objective for these actions are as described below:

1. Instream flow augmentations on CVP-controlled streams to protect salmon and steelhead and contribute toward meeting AFRP flow objectives
2. Increase releases from Goodwin Reservoir to help meet the 1995 Water Quality Control Plan (WQCP) requirements for San Joaquin River flows at Vernalis
3. Increase releases from Keswick and/or Nimbus reservoirs to help meet the WQCP fish and wildlife standards
4. Export reductions at the CVP Jones pumps to protect at-risk fish species (notably salmon, steelhead, and delta smelt) and to help meet the WQCP delta standards

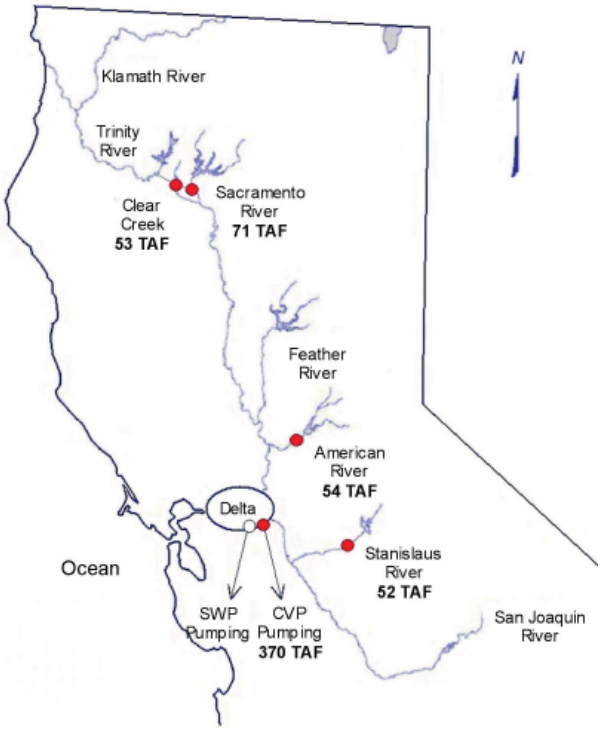


Figure 6. (b)(2) Use in WY 2008 in Thousand Acre-Feet (TAF)

Water Management

Related to the management of (b)(2) water, the 2000 CALFED Programmatic Record of Decision established an Environmental Water Account (EWA) program with the purpose of providing assurances to contractors and protection (supplemental to a hypothetical pre-EWA baseline level of protection) to the endangered fish in the Bay-Delta Estuary. Although accounted differently, the management of (b)(2) water is usually coordinated with the management of CALFED's EWA, since the use of both (b)(2) and EWA often contribute concurrently to the CVPIA's goal of doubling natural production of anadromous fish and protection of other fish and wildlife, including endangered fish species. However, in 2008 there was very little EWA water to manage.

In the 2008 water year, both the Sacramento and San Joaquin River Basins were classified as "critically dry," which resulted in reduced deliveries of CVP water to certain users within the CVP. For that reason, and consistent with Section 3406(b)(2) of the CVPIA and the Department of the Interior's (Interior) May 2003 (b)(2) Policy, total (b)(2) assets were ultimately limited to 600,000 acre feet during the 2008 water year. Further complicating CVP operations during the 2008 water year was the issuance of an Interim Remedial Order on December 14, 2007 in Natural Resource Defense Council v. Kempthorne, 1:05-CV-1207 OWW GSA (E.D. Cal.), for the protection of the federally-listed delta smelt.

Throughout the 2008 water year, Interior managed (b)(2) assets consistent with the Ninth Circuit's decision in Bay Inst. of San Francisco v. United States, 87 Fed. Appx 637 (2004), confirming Interior's discretion to give effect to the "hierarchy of purposes" in Section 3406(b)(2), Interior's May 9, 2003 (b)(2) Policy, and Interior's December 17, 2003 (b)(2) Guidance. At the end of the 2008 water year, however, Judge Wanger issued a memorandum opinion in San Luis & Delta Mendota Water Authority v. Department of the Interior, 1:97-cv-6140, 1:98-cv-5261 OWW DLB (E.D. Cal. Sept. 19, 2008), concerning Interior's (b)(2) accounting for the 2004 water year.[1] Thus, Interior accounted for fishery actions, including Endangered Species Act (ESA) and WQCP actions during the 2008 water year consistent with that opinion, as well as, the Ninth Circuit's decision in Bay Inst. of San Francisco, Interior's 2003 (b)(2) Policy, and 2003 (b)(2) Guidance.

[1] In that opinion, Judge Wanger stated that the "primary purpose" of CVPIA Section 3406(b)(2) "includes all those fish and wildlife restoration activities specifically described in section 3406(b)," including "water dedicated to accomplish the anadromous fish doubling goal set forth in section 3406(b)(1)" and "water needed to accomplish any of the other specifically enumerated programs listed in section 3406(b)(2). SLDMWA, at 43 (underline in original). Thus, "if an action taken under the WQCP and/or ESA predominantly contributes to one of the primary purpose programs (e.g., fish doubling), it must be counted toward the 800,000 AF limit." Id. at 48. In so doing, Judge Wanger recognized that there may be some "primacy" to section 3406(b)(1) in relation to other stated purposes of section 3406(b), but he did not rule on that question. Id. at 45.

Monitoring and Evaluation

The (b)(2) program includes monitoring and evaluation to assess the effectiveness of the use of the (b)(2) water.

Real-time fish monitoring helps inform (b)(2) decisions on when and where actions should be taken. On a weekly basis, fishery biologists and CVP and SWP operators update the CALFED Data Assessment Team on fish movements and project operations in the Sacramento River, San Joaquin River and the delta. The sites sampled include the mainstem Sacramento and San Joaquin rivers, their major tributaries and various locations in the delta, including the export facilities. Reclamation and the Service provide preliminary daily (b)(2) accounting periodically though the year and a final detailed accounting of (b)(2) fish actions on an annual basis, usually in December following the close of the water year. This information is posted on the U.S. Bureau of Reclamation, Mid-Pacific Region, Central Valley Operations Office home page at www.usbr.gov/mp/cvo.

Measuring Success

The 800,000 acre-feet annual allocation has been fully utilized each water year since 2000 when the (b)(2) accounting began, with three notable exceptions:

In wetter precipitation years (2005 and 2006) a portion of the dedicated water was banked pursuant to Section 3408(d) for use in the subsequent year. In water year 2008, which was critically dry, only 600,000 acre-feet of (b)(2) was available for fish actions (Table 8).

In addition to other restoration activities, the increased instream flows, made possible by CVPIA's (b)(2) provision, have helped maintain or improve salmon and steelhead habitat and populations in CVP-controlled streams, and export reductions at critical times have helped protect delta smelt as well as salmon and steelhead in the delta.

Uses of (b)(2) water in 2008 are listed in Table 9.

Table 8. Allocation vs. Use of (b)(2) Water (2001-2008)

	Use of Dedicated Water (Approximate)			
Year	(b)(2) allocated (acre-feet)	Fisheries (acre-feet)	Unused* (acre-feet)	Banked (acre-feet)
2001	800,000	798,000		
2002	800,000	793,000		
2003	800,000	796,000		
2004	800,000	800,000		
2005	800,000	672,000		128,000
2006	800,000	422,000	183,000	195,000
2007	800,000	798,000		
2008	600,000	600,000		

* Section 3406 (b)(2)(D): If the quantity of water dedicated under this paragraph, or any portion thereof, is not needed for the purposes of this section, based on a finding by the Secretary, the Secretary is authorized to make such water available for other project purposes.

Table 9. FY 2008 Use of (b)(2) Water

River	Action	Timeframe	Results
American	Augmented low base flows	December 2007 – April 2008	Contributed to meet AFRP flow objectives and improved instream conditions for fall-run Chinook and steelhead during spawning, incubation, rearing, and downstream migration
	Assisted in meeting WQCP delta requirements	May 2008	Contributed to AFRP flow objectives in May, benefitted fall-run Chinook and steelhead smolts, and predominantly contributed to the primary purpose of CVPIA Section 3406(b)(2)
Sacramento	Augmented low base flows	December 2007 – January 2008	Contributed to AFRP flow objectives and improved instream conditions for spring-run Chinook fry, fall-run Chinook, late fall-run Chinook, and steelhead during spawning, incubation, and rearing periods, and assisted in meeting WQCP delta standards
Clear Creek	Augmented low base flows throughout water year 2008	December 2007 – September 2008	Contributed to AFRP flow objectives and improved instream conditions for fall-run Chinook, spring-run Chinook, and steelhead during spawning, incubation, rearing, and downstream migration
Stanislaus	(b)(2) water used in conjunction with acquired (b)(3) water to provide pulse flow for adult Chinook migration and spawning	October 2007	Provided fall attraction flow for adult Chinook migration and spawning
	Augmented low base flows	November 2007 - January 2008	Contributed to AFRP flow objectives and improved instream conditions for fall-run Chinook and steelhead during spawning, incubation, and rearing periods
	(b)(2) water used in conjunction with acquired (b)(3) water to provide pulse in spring 2008 for juvenile salmonid outmigration (pursuant to VAMP)	April – May 2008	Improved survival of salmon smolts emigrating down the San Joaquin River and improved habitat conditions in the central and southern delta for numerous aquatic species
CVP Jones Pumping Plant	Export curtailments to assist in meeting WQCP delta requirements	November 2007 – January 2008 and March 2008	Protected estuarine habitat for anadromous fishes and other estuarine-dependent species
	Export curtailment related to delta Cross channel gate closure	December 2007	Benefitted winter-run and spring-run Chinook salmon outmigrants and other species
	Export curtailments to comply with Interim Remedial order (delta smelt entrainment concerns)	December 2007 - March 2008 and June 2008	Provided increased protection for delta smelt (ESA Threatened) and addressed entrainment at the CVP pumps
	Export curtailment to meet VAMP export target	May 2008	Benefitted San Joaquin Basin fall-run Chinook outmigration, contributed to AFRP flow objectives, and predominantly contributed to the primary purpose of CVPIA Section 3406(b)(2)

Water Acquisition Program – Instream Water

FY 2008

Funding Obligation

$3,750,000 – Instream Water (Restoration Fund)

$2,964,000 – VAMP (Restoration Fund)

$1,332,000 (State)

Accomplishments

- Acquired 106,490 acre-feet for San Joaquin River Agreement/Vernalis Adaptive Management Plan

CVPIA Sections 3406(b)(3) and 3406(g)

"The Secretary . . . is authorized and directed to develop and implement a program in coordination and in conformance with the plan required under paragraph (1) of this subsection for the acquisition of a water supply to supplement the quantity of water dedicated to fish and wildlife purposes under paragraph (2) of this subsection.... The program should identify how the Secretary intends to utilize, in particular the following options: improvements in or modifications of the operations of the project; water banking; conservation; transfers; conjunctive use; and temporary and permanent land fallowing, including purchase, lease, and option of water, water rights, and associated agricultural land."

The Water Acquisition Program (WAP) is charged to acquire water to supplement the 800,000 acre-feet of dedicated CVP yield for fisheries. The target for instream acquisitions is approximately 200,000 acre-feet per year, for use on the San Joaquin and Sacramento rivers and their tributaries, as described in the CVPIA PEIS/ROD. The WAP also acquires water for CVPIA-designated refuges and wildlife management areas. WAP activities for refuge water acquisitions are discussed in Section (d)(2) Water Acquisition Program-Refuge Water.

The WAP is designed to meet two primary objectives in support of the Anadromous Fish Restoration Plan:

- Improve spawning and rearing habitat
- Increase migration flows for fall-, winter- and spring-run Chinook salmon and steelhead

To date as noted below, very little water, and none in Water Year 2008, has been acquired for instream purposes north of the Delta.

Managing Flows Pursuant to San Joaquin River Agreement and Vernalis Adaptive Management Plan

In support of the second objective, WAP acquires instream flows in support of the Vernalis Adaptive Management Plan (VAMP) which is a component of the San Joaquin River Agreement (SJRA). This acquired water provides additional spring and fall fishery flows on the Stanislaus, Tuolumne, Merced, and lower San Joaquin rivers.

VAMP is a scientifically-based fishery management plan that determines the relationships between flows, exports, and other factors on fish survival in the Sacramento-San Joaquin Delta. The SJRA and VAMP govern the operation of water in the lower San Joaquin River to ensure that pulse flows and other flows are provided to support restoration of anadromous fish in the river. Specifically, the spring flows assist in the outmigration of juvenile salmonids and can help meet water quality requirements. Fall flows assist adult salmon migrating into the tributaries prior to spawning.

WAP acquires, and with the Central Valley Operations Office (CVO), in cooperation with the member agencies of the San Joaquin River Group Authority (SJRGA), manages water to provide additional spring and fall fishery flows on the Stanislaus, Tuolumne, Merced and lower San Joaquin rivers. The increased flows primarily benefit Chinook salmon, which can account for more than 70 percent of the statewide commercial harvest, as well as numerous resident and anadromous fish species.

Measuring Success

Since 2001, the program has acquired an average of approximately one half of the 200,000 acre-feet annual target almost exclusively on the lower San Joaquin. The actual volume of water acquired each year fluctuates based on the basin hydrology, reservoir storage and the water supplies available to WAP pursuant to the SJRA. The costs for the water acquired pursuant to the VAMP agreement are fixed by the SJRA.

As noted above, Reclamation has not been able to acquire the full 200,000 acre-feet of target flows, due to a lack of willing sellers as well as the high cost of water on the open market. In addition to the water identified in the SJRA, on occasion WAP has been able to acquire instream flows in the Sacramento Valley by entering into one-year transfers with local water agencies that have transferable water to sell.

In 2008, the program acquired 106,490 acre-feet for SJRA/VAMP. Table 10 shows the volume of water purchased for the years 1994 through 2008.

Table 10. Annual (b)(3) Instream Water Acquisitions (1994-2008)

Year	Annual Water Acquisitions in Acre-Feet (Percentage of 200,000 Acre-Feet Target)
1994	76,441 (38%)
1995	0
1996	16,161 (8%)
1997	155,983 (78%)
1998	80,000 (40%)
1999	174,498 (87%)
2000	108,880 (54%)
2001	109,785 (55%)
2002	68,105 (34%)
2003	91,526 (46%)
2004	98,211 (49%)
2005	148,500 (74%)
2006	148,500 (74%)
2007	92,145 (46%)
2008	106,490 (53%)

Tracy (Jones) Pumping Plant Program

FY 2008

Funding Obligation

$1,815,000 (Water & Related)

($14,970) (State)
Amounts in ( ) = credit amount

Accomplishments

- Continued study efforts to determine the Tracy Fish Collection Facility's present-day fish salvage efficiency
- Continued reassessment of the outdated Bates Table used for establishing fish hauling densities during transport
- Continued research and pilot studies for improved debris and predator management
- Continued recessed holding tank stress tests
- Collected water quality data at the entrance to the Delta Mendota Canal
- Distributed various Tracy Research Volume Series and publications
- Updated the Tracy Research Web site
- Completed replacement of fish transfer buckets, fish haul trucks and tanks
- Began construction of a new onsite research building

CVPIA Section 3406(b)(4)

"Develop and implement a program to mitigate for fishery impacts associated with operations of the Tracy Pumping Plant. Such program shall include, but is not limited to improvement or replacement of the fish screens and fish recovery facilities and practices associated with the Tracy Pumping Plant."

The original Tracy Fish Collection Facility (TFCF) was built in the 1950s to protect fish entering the Delta Mendota Canal (DMC) by way of the Jones Pumping Plant (JPP). The facility provides multi-use water from the Sacramento-San Joaquin Delta (Delta) to the Central Valley of California. The program's primary purpose is to mitigate for South Delta fishery impacts at the federal JPP. The program's current primary objective is to develop and implement new, modern day cost-effective fish collection, holding, transport and release technology and operational procedures that will significantly improve fish protection in the South Delta at the entrance to the JPP. The data and information generated will help evaluate present-day operations and efficiencies for TFCF, as well as assisting the Department of Water Resources (DWR) with improvements to their fish screens located at the JF Skinner Fish Protection Facility (Skinner).

Tracy Fish Facility Improvement Program (TFFIP) research is performed in cooperation between Reclamation's Mid-Pacific Region and research and engineering groups at the Denver Technical Service Center. Research planning and execution is enhanced through coordination, review and assistance from other agencies including DFG, DWR, the Service, and NMFS.

Figure 7. Tracy (Jones) Pumping Plant

Universities, private consultants, and the San Luis Delta Mendota Water Authority also provide assistance.

Due primarily to budgetary constraints, Reclamation and DWR decided in 2005 not to proceed with construction of new full-scale testing/fish screen facilities in the South Delta, instead opting to develop and implement actions at the existing TFCF and Skinner (including improved technology and operational procedures) to reduce fish losses and improve fish salvage success while meeting the CVPIA's goal. This was the outcome of the CALFED South Delta Fish Facility Forum (SDFF) discussions in 2005 which included representatives from the state and federal water agencies, regulatory agencies, and stakeholders interested in South Delta exports and fishery impacts. Many of the regulatory requirements were also contained in the 2004 National Oceanic and Atmospheric Administration (NOAA) Fisheries and Service CVP OCAP BO's.

Since the program was implemented, physical and operational changes have already significantly shown improvement in Reclamation's ability to successfully salvage all species of delta fish, including anadromous fish, and release them safely back into the delta estuary. However, since the decision to focus on improving existing South Delta fish screens instead of moving forward on construction of new fish screens in the South Delta was made in 2005, Reclamation estimates that it will take approximately another five to seven years to fully assess the existing TFCF and implement and evaluate all remaining physical and operational improvements presently identified at TFCF.

To date, Reclamation has identified 23 "actions" related to improving fish protection at the existing TFCF. Implementation of these actions has been ongoing since 1992 at TFCF and full implementation is not expected until 2013 at the earliest. Additional actions could be added to the program as needed, in response to any unforeseen issues or concerns that may require further analysis, assessment and improvements. The program has not defined fish loss reduction targets; rather, the program's present goal is to implement and complete the 23 identified actions.

Although the refocused 2005 TFCF improvement program has not been in place long enough for complete assessment, preliminary results have revealed that several factors have made the Tracy facility less effective towards screening and salvaging fish than it was in the 1950s:

1) **Changes in South Delta hydrology** - Implementation of the SWP, in addition to increased pumping at Jones and other delta actions, lowered the water elevation at Tracy by a few feet and increased primary channel velocities
2) **Invasive species** - Introduction of new vegetative species such as water hyacinth and egeria densa (pond weed) have caused clogging of screens and other equipment, resulting in a higher level of fish stress and mortality and causing the louvered bypass system to operate less efficiently, thus resulting in fewer fish making it to the holding tanks for transport back out to the delta
3) **Predators** - An increase in predators, such as striped bass, within the TFCF has caused a significant increase in fish mortality during the salvage process, prior to and including fish holding and hauling

Measuring Success

Program Actions

To date, the program has completed 14 of 23 actions, or 61 percent of the program's present goal. Actions in 2008 included continued study efforts to determine the TFCF's present-day fish salvage efficiency, continued reassessment of the outdated Bates Table used for establishing fish hauling densities during transport, ongoing improvement to debris and predator management as well as hydraulic control of the facility, continuation of recessed holding tank stress tests, collection of water quality data at the entrance to the DMC, distribution of various Tracy Research Volume Series and publications, and updating the Tracy Research Web site. Also, Reclamation completed replacement of fish transfer buckets, fish haul trucks and tanks, and began constructing a new onsite research building.

Program Research

The program has published 41 volumes of research-related activities to date. The information from the Tracy Research Volume Series includes Technical Publications and a PhD Dissertation and is used by Reclamation in implementing improvements at the TFCF as well as by DWR for implementing improvements at the Skinner facility. In addition, information generated from the research and assessment efforts at the TFCF is used by other scientists when assessing fishery impacts at the export pumps on a delta-wide scale. In 2008, the program completed distribution of Tracy Research Volume Series Nos. 34, 35, 37, & 41, distribution of Tracy Technical Bulletins 2008-1, -2 and -3, and facilitated ongoing development of the Tracy Research technical website and enhanced data accessibility. The program also published a PhD Dissertation related to fish holding stress on Chinook salmon.

The information contained on the website is used by many scientists and engineers studying the Sacramento-San Joaquin Delta region for fishery and water quality affects and concerns.

In 2009, the program will continue to address the three primary areas of concern, namely improved debris management, improved predation management, and improved hydraulic control of the facility.

Tracy Fish Collection Facility

Contra Costa Canal Pumping Plant

FY 2008

Funding Obligation

$55,000 (Water & Related)

($2,500) (State)
Amounts in ( ) = credit amount

Accomplishments

- Conducted fish monitoring
- Continued discussions with the Service for operation beyond the year 2008 in the absence of a screening facility
- Consulted under ESA and the Coordination Act with the Service on the Los Vaqueros BO as it relates to the environmental commitment of the Rock Slough Fish Screen
- Continued to negotiate appropriate mitigation to the Service for the Sacramento-San Joaquin Delta Pelagic Organism Decline effort

Rock Slough

CVPIA Section 3406(b)(5)

"…Develop and implement a program to mitigate for fishery impacts resulting from operations of the Contra Costa Canal Pumping Plant No. 1. Such a program shall provide for construction and operation of fish screening and recovery facilities, and for modified practices and operations."

Part of the Contra Costa Canal is the backbone of the Contra Costa Water District (CCWD), delivering water from the delta to the district's treatment facilities and raw-water customers. The canal is a 48–mile–long facility that starts at Rock Slough in East Contra Costa County and ends at the Terminal Reservoir in Martinez. Four pumping stations currently lift water 124 feet above sea level from Rock Slough, then gravity propels the water to its terminus in Martinez.

Operation of the Contra Costa Pumping Plant No. 1, without adequate screening or alternative mitigation, results in fish mortality. In addition to the CVPIA mandate, the 2004 Los Vaqueros BO extension, requires that a fish screen be built at Rock Slough. This program is focused on improving operation of the Rock Slough Intake to minimize loss of fish through three main activities:

- Design and construct a fish screen for CCWD's Pump #1 and one or more new intake structures
- Work with CCWD to modify operations (change the pumping schedule)
- Make interim annual mitigation payments to the Service to compensate for presumed losses of delta smelt during continued Contra Costa Pumping Plant operation in the absence of a fish screen

Because fish losses at pumping stations, dams and diversions are of concern throughout the CVP system, currently several CALFED Stage 1 studies are under way, including the Los Vaqueros Reservoir Expansion Study, Rock Slough Water Quality Improvement Study, and various ecosystem restoration projects and studies. These studies may benefit other agencies, including the Tracy (Jones) Pumping Plant Program (b)(4), the AFSP (b)(21), and other Central Valley actions for endangered species.

These studies have the potential to significantly alter the currently designed fish screen facility at Rock Slough or to eliminate the need for a screened diversion altogether. In anticipation of this more rigorous and elaborate analysis, alternative short-term, lower-cost fisheries mitigation measures are being investigated and developed, including short-term operational flexibility, alternative exclusionary measures, and monitoring and salvage procedures.

Measuring Success

Fish Screen

In 1996, the Contra Costa Fish Screen Management Team and the Contra Costa Technical Advisory Committee (Team),[1] were formed to provide technical assistance to the (b)(5) program, reviewing preliminary designs and recommending cost-saving alternatives and improvements. By 2002, the group had completed 90 percent of the fish screen designs and related environmental documents. However, because of concerns regarding the cost and effectiveness of the proposed screen design, Reclamation reassessed all available design alternatives, completing this review in 2007. Also in 2007, Reclamation contracted an interim Cumulative Impacts Assessment for the Contra Costa Canal Mitigation Program, which will serve as the basis for future National Environmental Policy Act (NEPA) documentation. This document presents the potential effects of the currently identified potential fish screen alternatives. Fish monitoring continued through 2008 according to the monitoring plan.

1 The team is made up of representatives from DFG, DWR, Service, Reclamation, NOAA Fisheries, and the Contra Costa Water District (CCWD)

Figure 8. Rock Slough Fish Screen (Proposed)

Modifying Operations

In 1997, water supply through Rock Slough was reduced to approximately 17 percent of the CCWD total. This reduction was made possible by the Los Vaqueros Project, which constructed a new screened intake at Old River, allowing a greater amount of water to be pumped from that location. With the 1997 reduction in water intake at Rock Slough, the Service agreed to extend the deadline date for construction of a fish screen until 2008. The program continued discussions with the Service for operation beyond the year 2008 in the absence of a screening facility. This includes mitigation for each year that Reclamation extends or surveys actions related to listed species impacted by the CVP. Currently, no conclusions have been reached.

The program is currently consulting under ESA and the Coordination Act with the Service on the Los Vaqueros BO as it relates to the environmental commitment of the Rock Slough Fish Screen.

Mitigation Payments

In 2008, the program continued to negotiate appropriate mitigation to the Service for the Sacramento-San Joaquin Delta Pelagic Organism Decline effort to address the dramatic recent decline of species such as the delta smelt.

Flow Fluctuations and Reservoir Storage

FY 2008

Funding Obligation

$31,000 (Restoration Fund)

Accomplishments

Minimized losses of anadromous fish due to flow fluctuations by:

- Maintaining Clear Creek flows using a combination of (b)(2) water and (b)(1)B reoperation
- Augmenting Sacramento River flows in December 2007 and January 2008 with (b)(2) water to minimize dewatering fall-run Chinook redds
- Augmenting American River flows from December 2007 through mid-April 2008 using (b)(2) water
- Augmenting Stanislaus River flows from mid-October 2007 through early March 2008 using a combination of (b)(2) and (b)(3) water

The American River from Guy West Bridge

CVPIA Sections 3406(b)(9) and 3406(b)(19)

"(9) Develop and implement a program to eliminate, to the extent possible, losses of anadromous fish due to flow fluctuations caused by the operation of any Central Valley Project storage or re-regulating facility…"

"(19) Reevaluate existing operational criteria in order to maintain minimum carryover storage at Sacramento and Trinity River reservoirs to protect and restore the anadromous fish of the Sacramento and Trinity Rivers in accordance with the mandates and requirements of this subsection and subject to the Secretary's responsibility to fulfill all project purposes, including agricultural water delivery."

The timing and volume of water flows are critically important to the successful spawning, rearing and out-migration of anadromous fish. River and stream flow fluctuations caused by operation of any CVP storage or reregulating facility can therefore result in fish losses through mortality of holding and spawning adults, decreased egg viability in redds due to thermal distress, redd dewatering and isolation, or stranding of juveniles. The CVPIA (b)(9) Flow Fluctuation Program's goal is to minimize these losses by moderating changes in CVP releases on Clear Creek and the Sacramento, American, and Stanislaus rivers to the extent possible to protect and restore anadromous fish to the Central Valley (see Figure 1 for location map).

The tools available to minimize losses include (b)(1)B reoperation (changing dam operations based on (b)(1)B

data) and the use of the dedicated yield in section 3406 (b)(2). To date, a specific performance goal has not been established for this program.

Supporting the (b)(9) Flow Fluctuation Program is the (b)(19) Reservoir Storage Program, which evaluates water storage across the Sacramento, American and Trinity rivers to meet anticipated demands for water by fisheries as well as agricultural, municipal and industrial users. The Reservoir Storage Program seeks to maintain carryover water storage and to deliver appropriately timed flows and flows of adequate quality to support fisheries restoration as well as meet other project purposes. To date, a specific performance goal has not been established for this program.

Measuring Success

Clear Creek: Outside of flood control periods or large precipitation events, there typically are no extreme flow fluctuations on Clear Creek. In water year 2008 (October 2007 through September 2008), Clear Creek flows were maintained using a combination of (b)(2) water and (b)(1)B reoperation. Large flow fluctuations originating from Whiskeytown Dam did not occur.

Sacramento River: On December 1, 2006, a flow fluctuation study was published by the Service (pursuant to Section 3406 (b)(1)B that identified the relationships between flow fluctuations and redd dewatering and juvenile stranding for Chinook salmon and steelhead in the Sacramento River between Keswick Dam and Battle Creek. Using this information, Reclamation and the Service convened weekly interagency (b)(2) team meetings in water year 2008 to determine how to minimize damaging flow fluctuations on the Sacramento River to the extent possible. In December 2007 and January 2008, Sacramento River flows were augmented with (b)(2) water to try to minimize dewatering fall-run Chinook redds, which had been constructed in October and November 2007 at flows greater than 5,700 cfs. Absent the (b)(2) augmentation, base flows on the Sacramento River would have dropped to 3,250 cfs beginning in mid-December. Interior used (b)(2) water to maintain moderate flows (i.e., 4,000 – 4,500 cfs) through the emergence period and gradually reduced flows to 3,250 cfs by late January 2008.

American River: On December 11, 2001, a 1997-2000 flow fluctuation study was published by the DFG that documented the optimal flow rates and flow timing to support fisheries restoration for salmon and steelhead in the lower American River. In 2008, the data and conclusions from this study were used as guidance in discussions about the operation of Folsom Reservoir (the major contributor to flows in the lower American) at monthly American River Group meetings with stakeholders as well as for weekly (b)(2) interagency team meetings. In water year 2008, American River flows were augmented using (b)(2) water from December 2007 through mid-April 2008. Large flow fluctuations during critical fish periods did not occur.

Stanislaus River: In July 2004, the DFG completed an early draft report on the Stanislaus River flow fluctuation study, which will be completed in 2009. Data and conclusions from this study will be used in future years to facilitate discussion and decision-making regarding the operation of flows on the Stanislaus River, including the operation of Goodwin, Tulloch and New Melones dams, which are the primary generators of flows. In water year 2008, Stanislaus River flows were augmented using a combination of (b)(2) and (b)(3) water from mid-October 2007 through early March 2008. Large flow fluctuations during critical fish periods did not occur.

Red Bluff Diversion Dam

FY 2008

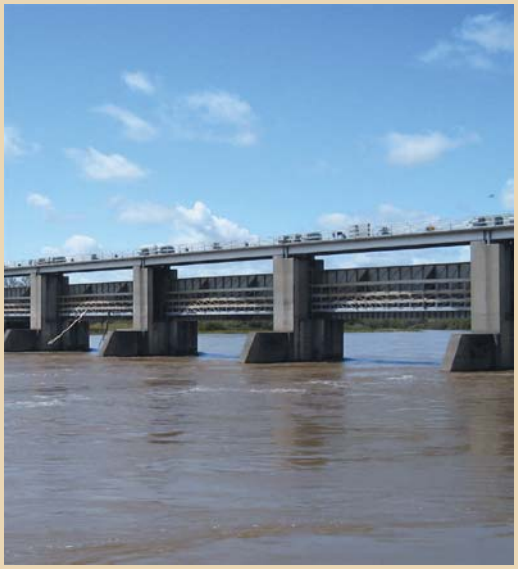
Funding Obligation

$5,636,000 (Water & Related)

($2,000) (State)
Amounts in ( ) = credit amount

Accomplishments

- Achieved unimpeded passage for approximately 20 percent of the adult spring-run Chinook and approximately 50 percent of the green sturgeon based on the current operation of the facility (four-month closure of the gates)
- Observed no further green sturgeon fatalities after operational changes were implemented by Reclamation at RBDD in 2007 (gates are kept "open" or raised a minimum of one foot from the river floor)
- Signed a Record of Decision on July 16, 2008, following completion of ESA consultation on the planned construction of a new pumping plant.



Open gates at Red Bluff Diversion Dam

CVPIA Section 3406(b)(10)

"Develop and implement measures to minimize fish passage problems for adult and juvenile anadromous fish at Red Bluff Diversion Dam…"

The Red Bluff Diversion Dam (RBDD) is located on the Sacramento River about 2.5 miles southeast of the city of Red Bluff. The dam diverts water to the Tehama-Colusa and Corning canals to provide water for farmers, the Sacramento National Wildlife Refuges (SNWR), and minor municipal and industrial uses. In the summer, the dam creates a seasonal lake in a wide portion of the Sacramento River, which attracts wildlife as well as recreational users.

As recently as 1987, the RBDD gates remained closed year round, impeding migration of salmonids above the dam and preventing passage of sturgeon. In 1987, the gates were opened between December 15 and April 1, and the program saw a resultant change in spawning distribution with less spawning below the RBDD and more spawning in colder water above the dam. However, the improved passage still delayed or blocked many adult winter- and spring-run Chinook and continued to cause spawning in downstream waters too warm for successful egg incubation. Adult green sturgeon (ESA-listed) and white sturgeon were also blocked and losses of out-migrating juvenile salmon were also measured at up to 50 percent. Increased feeding and ambush settings created a dysfunctional predator-prey relationship between the out-migrating salmonids and the native Sacramento pikeminnow.

A 1993 biological opinion (BO) required that the gates remain out of the river or "open" for eight months of the

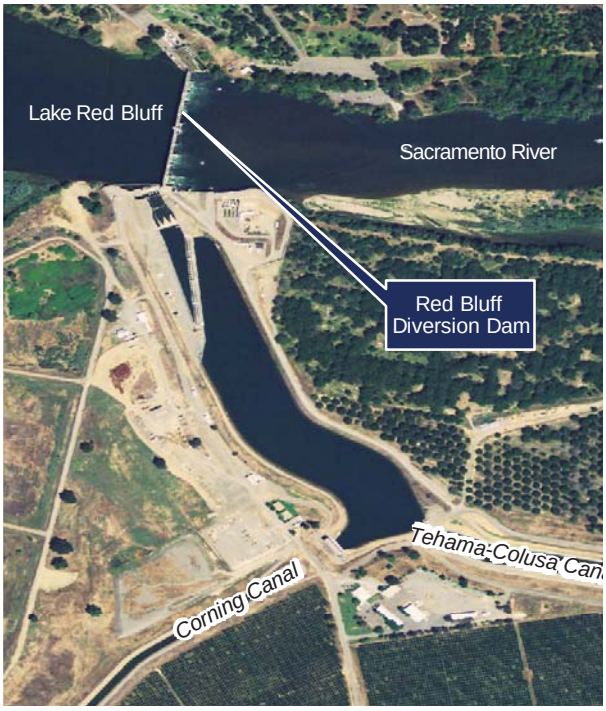


Figure 9. Red Bluff Diversion Dam

year (from September 15 through May 15); as a result of this and complementary CVPIA actions, the population index for the winter-run Chinook dramatically increased and juvenile predation dropped.

Winter-run Chinook spawning returns showed a significant population increase from nearly 700 to 17,000 after 1998 through 2006, and both the fall- and winter-run spawning distributions changed significantly before and after the raised gates period–after gates were raised, fish spawned further upriver (see figure 10).

In 2007, Reclamation implemented operational changes at RBDD in response to the loss of at least 10 adult green sturgeon at or below the dam. The loss is attributed to gates operations at Red Bluff based on the presence of an unusually large number of green sturgeon "holding" in the vicinity of the dam, the nature of the injuries seen on carcasses, and the location of some carcasses. It was inferred that the fatalities occurred when the gates were lowered for a brief, emergency closure and/or when the gates were closed for the season. To protect the fish from further losses, when possible, gates are now kept "open" or raised a minimum of one foot from the river floor.

Reclamation and the Tehama Colusa Canal Authority issued a draft EIS/EIR in 2002 to evaluate six combinations of a new pumping plant, gravity diversions, fish ladders and gates' open/close timing to improve fish passage. Delays resulted from the then potential listing of the green sturgeon as a threatened and endangered species. Following listing, it was decided to recirculate the EIS/EIR in 2006 to include discussion of the Operations Criteria and Plan (OCAP) BO then in effect and its requirements, as well as to make it clear the assessment of the potential impacts to the green sturgeon was unchanged. Reclamation's stated preference to help achieve fish passage targets is for a two-month gate closure and construction of a new pumping plant, which will provide a more reliable supply of water while also protecting fish through the use of screens. However, operations of a new pumping plant would be determined as part of the OCAP ESA consultation and the BO which is expected to be issued in 2009. Also, full funding has not yet been secured. Therefore, a specific timeframe for achieving the infrastructure improvements and the fish passage targets has not been determined.

The purpose of the Red Bluff Fish Passage Improvement Project is to minimize anadromous fish passage problems to allow access to and safe egress from upstream habitat while maintaining water deliveries to the SNWR and other water contractors. The program focuses on one outcome target and two output targets, as follows:

- Outcome target: achieve annual passage of 80 to 100 percent of adult spring-run salmon and 50 to 100 percent of adult green sturgeon
- Output target: supply Full Level 4 water to the SNWR
- Output target: complete RBDD infrastructure improvements as necessary to achieve annual fish passage targets and to be capable of full time operation, if needed

One of the program goals has been met:

Refuge Water Conveyance Capacity

The mandated goal to supply Full Level 4 water to the SNWR has been met. The goal was met after evaluation of eight options by installation of a siphon on the Glenn-Colusa Irrigation District (GCID) Canal at Stony Creek to allow year-round deliveries. Use of the RBDD for this purpose was therefore abandoned, although the planned changes at Red Bluff will provide a back-up to conveyance via GCID's facilities.

Measuring Success

Fish Passage

Based on the current operation of the facility (four-month closure of the gates), approximately 20 percent of the adult spring-run Chinook and approximately 50 percent of the green sturgeon achieve unimpeded passage.

No further green sturgeon fatalities were observed in 2008 in response to the operational changes implemented by Reclamation at RBDD in 2007 (gates are kept "open" or raised a minimum of one foot from the river floor).

Infrastructure Improvements

A Record of Decision was signed July 16, 2008, following completion of ESA consultation on the planned construction. Alternative 2b of the EIS/EIR was identified as the preferred alternative; it includes keeping gates out or "open" for 10 months of the year (closing them only in July and August), adding a fourth pump to the Red Bluff Research Pumping Plant (RBRPP) and building a 1,680-cfs pumping plant that would increase the existing pumping capacity fourfold, providing a more reliable water supply. (Subsequent ESA consultations have assumed construction of a 2,500 cfs facility, forgoing any reliance on the existing pumping plant.)

Decisions concerning operation, however, will be deferred until completion of the OCAP consultation, which involves ESA consultation for the CVP as a whole and will likely include specific requirements for the pumping plant related to the listing of green sturgeon as a threatened species. Design of a new pumping facility is in progress.

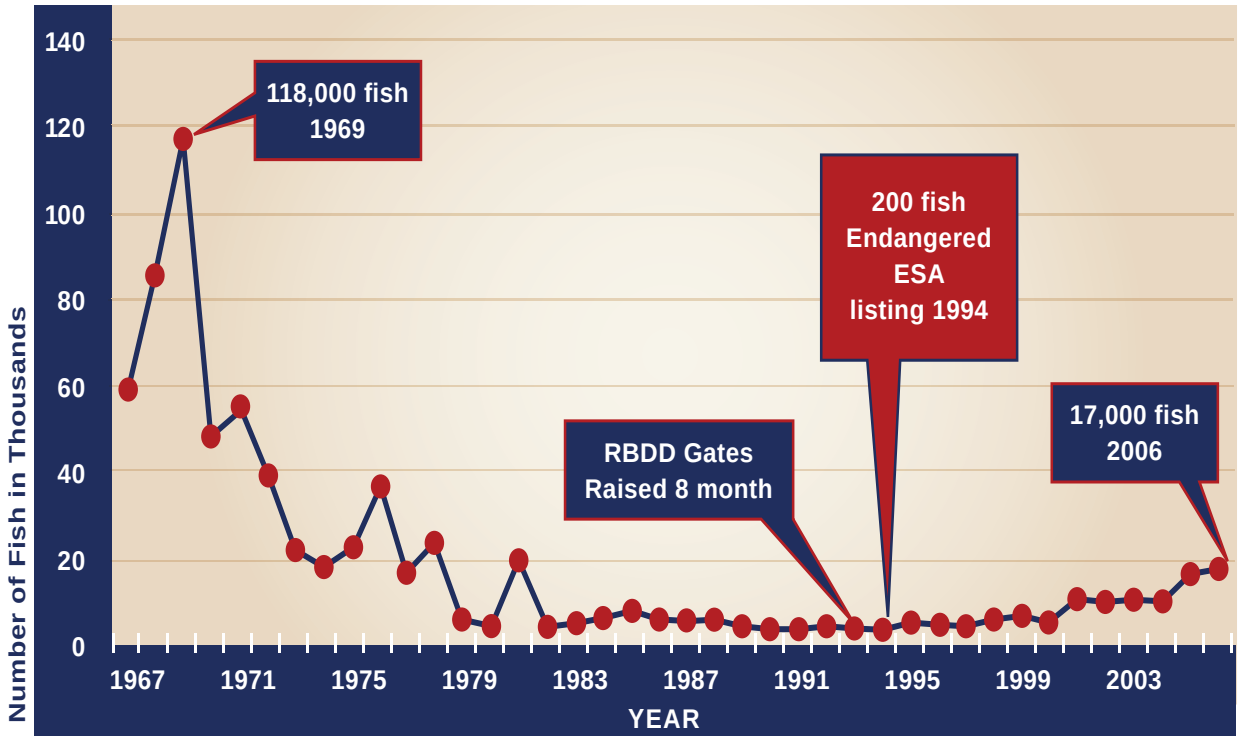


Figure 10. Spawning Returns, Winter-Run Chinook, Sacramento River (1967-2006)

Coleman National Fish Hatchery

FY 2008

Funding Obligation

$826 (Water & Related)

Accomplishments

- Completed the design of a visitor kiosk at the Coleman NFH

Modifications to Keswick Fish Trap

CVPIA Section 3406(b)(11)

"Rehabilitate and expand the Coleman National Fish Hatchery by implementing the U.S. Fish and Wildlife Service's Coleman National Fish Hatchery Development Plan, and modify the Keswick Dam Fish Trap to provide for its efficient operation at all project flow release levels and modify the basin below the Keswick Dam spillway to prevent the trapping of fish…"

The Coleman National Fish Hatchery (NFH) Complex is one of the largest production facilities of salmon and steelhead in the United States. The hatchery, located on Battle Creek near the town of Anderson, was constructed in 1942 to partially offset impacts to salmon and steelhead populations caused by the construction of the Shasta and Keswick dams–which had eliminated almost 200 miles of salmon and steelhead habitat.

In order to continue to mitigate the effects of these dams, the goals of Section 3406(b)(11) of the CVPIA are as follows:

- Rehabilitate and expand the Coleman NFH by implementing the Station Development Plan for Coleman NFH on Battle Creek
- Modify the fish trap at Keswick Dam to ensure efficient operation at all project flow release levels
- Modify the basin below the Keswick Dam spillway to prevent the trapping of fish

The program has an output-based performance goal to complete the infrastructure improvements to enhance conditions for anadromous fish and

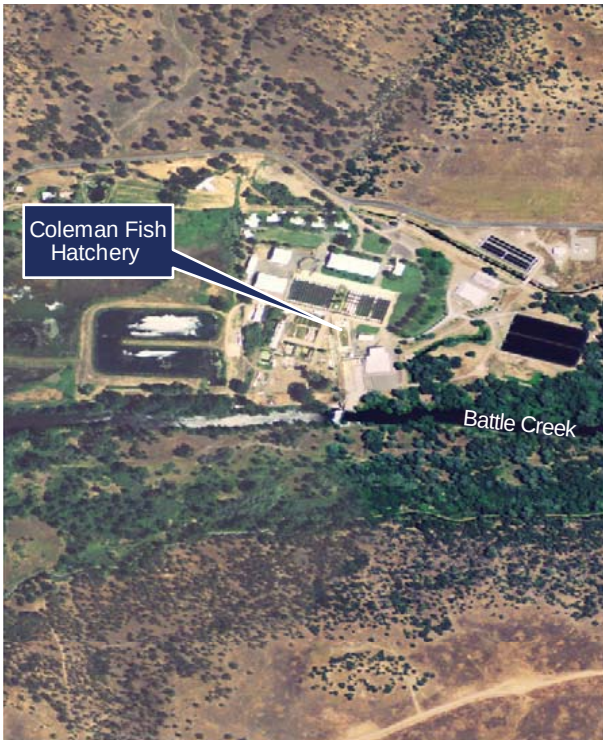


Figure 11. Coleman Fish Hatchery

maintain hatchery production targets as identified in the 1987 Coleman National Fish Hatchery Station Development Plan (SDP) and subsequently modified over the last 20 years by management requirements.

Specific modifications to the SDP include non-completion of Phases 6, 7 and 8, which called for expansion of a water treatment facility up to 65,000 gallons per minute (gpm) and the construction of 20 additional 15-foot by 150-foot raceways for juvenile rearing. Further, while the SDP called for provisions to produce winter Chinook salmon at Colman NFH, a multi-agency decision resulted in the use of $1 million of CVPIA funds for constructing the Livingston Stone National Fish Hatchery in 1997 below Shasta Dam for the production of that species. Subsequently, the production targets, as identified in the Coleman NFH's 2001 biological assessment, are as follows:

- Livingstone Stone NFH: Approximately 200,000 winter-run Chinook salmon pre-smolts
- Coleman NFH: 12 million fall-run Chinook salmon smolts, 1 million late-fall-run Chinook salmon smolts and 600,000 steelhead smolts

Measuring Success

The 1987 SDP outlined a nine-phase strategy to rehabilitate the hatchery and implementation was authorized through the 1992 passage of CVPIA legislation. As shown in Table 11, four of these phases were largely implemented prior to 1994 CVPIA funding with approximately $11.2 million from the Service. Since CVPIA funding of (b)(11) began in 1994, CVPIA has invested an additional $22 million to further the goals of the SDP. Due to fish production modifications and resource management decisions by program management, to date three phases have been cancelled or suspended. The two phases that remain to be implemented are expected to be completed by 2010.

Fish Production Targets

Fish production targets have essentially been met since the 1998 construction of Livingston Stone NFH. Actual annual production may vary around the target depending on factors such as numbers of available brood stock and egg survival rates.

Ozone Water Treatment Facility

Since the ozone water treatment facility reached full ozone production capacity of 30,000 gpm in 2000 (full water filtration capacity of 45,000 gpm reached in 2002), juvenile fall-run Chinook from brood years 1999-2006 were reared and released with no incidence of viral disease. This was a first in the history of the hatchery. Also important is that the construction of the water treatment facility supports the CALFED-funded Salmon and Steelhead Restoration Project's efforts to restore 42 miles of habitat in upper Battle Creek by promoting and allowing opportunity for passage of adult anadromous salmonids above the hatchery's water source. Although the anadromous salmonids that ascend Battle Creek above the hatchery's water source carry a variety of pathogens, the ozone water treatment plant disinfects the water and reduces the likelihood of on-station disease outbreaks.

Domestic Water System and Visitor Facility Improvements

In 2005 and 2006, the CVPIA implemented a program to rehabilitate the domestic water system to ensure high-quality treated drinking water for station staff and the tens of thousands of visiting public.

In 2006, the program began design of a visitor kiosk and informational panels at the Coleman NFH; design was completed in FY 2008. Construction is expected to be initiated in FY 2009. Construction cost overruns have precluded the ability to purchase information panels.

Table 11. Coleman NFH Facility Rehabilitation Phases (1991-2008)

Phase	Status	Funding
1. Water treatment facility to 20,000 gpm	Completed pre-1999	Service, Reclamation
2. Facility Rehabilitation	In process	Service, Reclamation
3. Feed storage building	Completed 1991	Service
4. Barrier weir and fish ladder	Completed 1992	Service
5. Pollution abatement system	Completed 1992	Service
6. Increase treatment plant size to ozone generation from 20,000 gpm to 45,000 gpm	Ozone water treatment and water filtration facilities reached 30,000 gpm capacity in 2000 and 45,000 gpm capacity in 2002; no plans to further build out ozone facility to full capacity as prescribed by Phase 6 of the SDP	Reclamation
7. Construction of 20 additional 5-foot by 150-foot raceways for juvenile rearing	No longer applicable	No longer applicable
8. Increase plant size from 45,000 gpm to 65,000 gpm	No longer applicable	No longer applicable
9. Improve visitor facility	In process	Reclamation

Clear Creek Restoration Program

FY 2008

Funding Obligation

$611,000 (Restoration Fund)

$99,000 (Water & Related)

Accomplishments

- Flows have increased to 200 cfs from mid-September through mid-June and to approximately 70 to 90 cfs during the summer
- Flows to achieve temperature control were met 99 percent of the time
- Gravel was added at Whiskeytown Dam (1,000 tons), Placer Road Bridge (3,000 tons), Phase 3A (1,500 tons), and Phase 2A (3,000 tons)
- Phase 3B channel relocation and floodplain reconstruction was completed
- Fall Chinook escapement was 4,129 compared to the average baseline escapement of 1,689 between 1967 and 1991
- Adult spring-run Chinook increased from a low of zero in 2001 to 200 in 2008
- Adult steelhead populations increased, as indicated by redd counts, from approximately 38 in 2001 to 159 in 2008
- Initiated monitoring for benthic macro-invertebrate sampling to compare the effectiveness of the restoration projects
- Initiated monitoring for mercury sampling during storms to evaluate the impact of Phase 3B on total mercury in Clear Creek

CVPIA Section 3406(b)(12)

"Develop and implement a comprehensive program to provide flows to allow sufficient spawning, incubation, rearing, and outmigration for salmon and steelhead from Whiskeytown Dam as determined by instream flow studies conducted by the California Department of Fish and Game after Clear Creek has been restored and a new fish ladder has been constructed at the McCormick-Saeltzer Dam…"

The original construction of McCormick-Saeltzer Dam in 1903, modifications to McCormick-Saeltzer Dam in 1912, continued operation of McCormick-Saeltzer Dam, construction of Whiskeytown Dam in the 1960s and aggregate and gold mining in Clear Creek, caused widespread degradation of the creek habitat. This led to precipitous drops in Chinook and Steelhead salmon spawning and juvenile production. In order to reverse the trend, CVPIA developed and implemented a restoration program that improved instream habitat allowing greater spawning and rearing success.

The program focuses on five distinct problem areas and uses the following goals to track progress:

1) Instream flow: Use approximately 80,000 acre-feet of (b)(2) water dedicated annually; variable target dependant on hydrology and biological conditions
   - Allow provision of at least 90 percent of the maximum possible habitat
   - Meet temperature targets at least 98 percent of days with no more than two consecutive temperature exceedence days

2) Fish passage: Obtain unimpeded fish passage provided past McCormick-Saeltzer Dam site through its removal

3) Gravel placement: Recreate 347,288 square feet of usable spawning habitat that existed before construction of Whiskeytown Dam by 2020 by adding 17,000 tons of gravel annually

4) Channel restoration: Restore two stream miles by 2010

5) Erosion control: Implement highest priority and cost effective erosion control projects by 2003

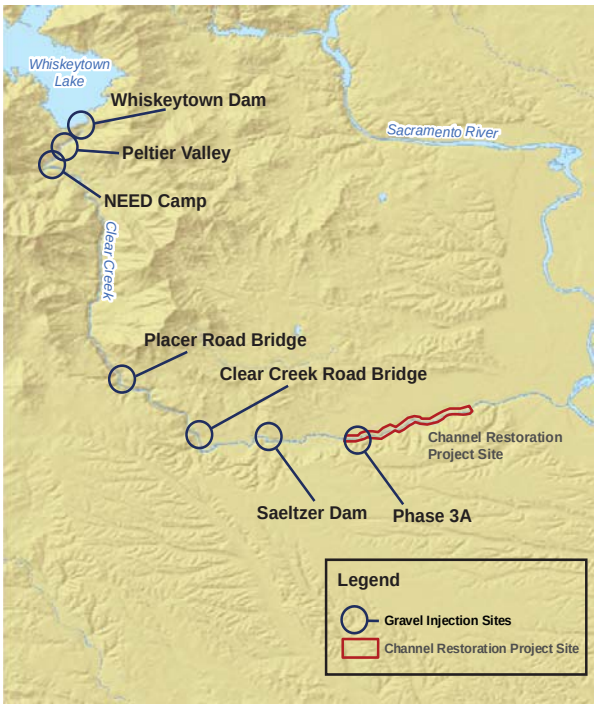


Figure 12. Gravel Injection and Channel Restoration Sites

Two of the program goals have been met:

Fish Passage

Passage at McCormick-Saeltzer Dam was achieved in 2000 through the dam's complete removal and the opening of 12 additional miles of habitat.

Erosion Control

The highest priority erosion areas were completed prior to 2003 (specifically, work on approximately 13 miles of dirt roads). An Erosion Inventory Report was completed in 1996. Between 1997 and 2001, the highest priority erosion control projects were implemented by cooperators from the Western Shasta Resource Conservation District, the Service, National Park Service (NPS), and the Bureau of Land Management (BLM). All feasible and cost-effective projects were finished by 2001 and no further work is expected.

Measuring Success

Progress against the remaining program goals is summarized in the following sections.

Instream Flow

An average of approximately 70,000 acre-feet of (b)(2) water is used annually to meet flow requirements, temperature objectives, and the instream habitat goal.

Pre-CVPIA baseline flows were 50 cfs between January and October, and 100 cfs in November and December. Flows have increased to 200 cfs from mid-September through mid-June and to approximately 70 to 90 cfs during the summer.

Flows to achieve temperature control of 60°F from June 1 through September 15 and 56°F from September 15 through October 31 were met 99 percent of the time in 2008.

Lastly, the program has met the instream habitat goal of 90 percent weighted useable area for the last six years including in FY 2008.

Gravel Placement

Since 1995, an estimated 103,371 tons of gravel have been injected at specific locations on the creek, resulting in a steady increase in spawning habitat. This added gravel has recharged spawning gravel within approximately three miles of creek. In 2008, gravel was added at Whiskeytown Dam (1,000 tons), Placer Road Bridge (3,000 tons), Phase 3A (1,500 tons), and Phase 2A (3,000 tons).

Securing a long-term gravel supply is critical for re-establishing sediment transport processes that create and maintain fish habitat. In FY 2008, a feasibility study was completed and a contract for design and permitting was initiated for the Cloverview long-term gravel supply project that could supply 23 years worth of gravel for Clear Creek at a fraction of the current cost.

Channel Restoration

The two-mile stream channel is 80 percent restored (Figure 16). Phases 1, 2A, 2B, and 3A are complete. Phase 3B channel relocation and floodplain reconstruction was completed November 2007 (FY 2008). Phase 3B floodplain revegetation began in September 2007 and will continue through April 2009. Phase 3C is not complete. An inventory of future channel restoration needs was initiated but canceled due to the shortfall in Restoration funding in 2008.

Adaptive Management and Monitoring

Through addressing the program goals, the Clear Creek Restoration Program has increased fall-run Chinook escapement, and steelhead and spring-run Chinook populations. In 2007 (FY 2008), fall Chinook escapement was 4,129 compared to the average baseline escapement of 1,689 between 1967 and 1991, as shown in Figure 13. Similarly, adult steelhead populations also continued to increase, as indicated by redd counts, increasing from approximately 38 in 2001 to 159 in 2008. Figure 14 depicts the increase of adult spring-run Chinook from a low of zero in 2001 to 200 in 2008.

Despite the increases in adult populations, juvenile production has decreased since 1996 from 7.4 to 3.4 million fish, and the number of juvenile fall-run Chinook produced per adult female has decreased

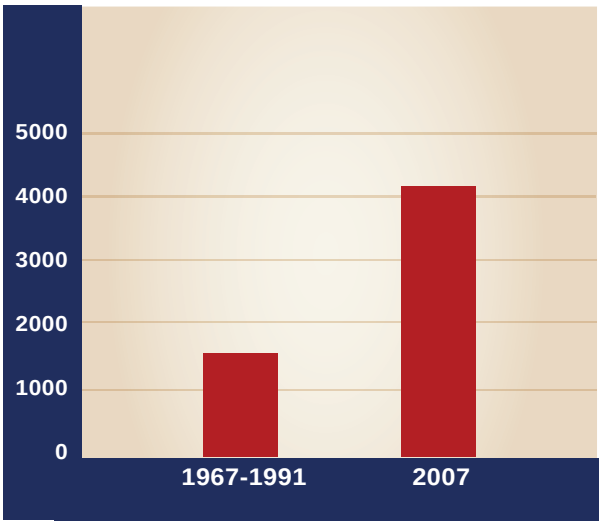


Figure 13. Fall–Run Chinook Salmon Escapement, Clear Creek (2007)

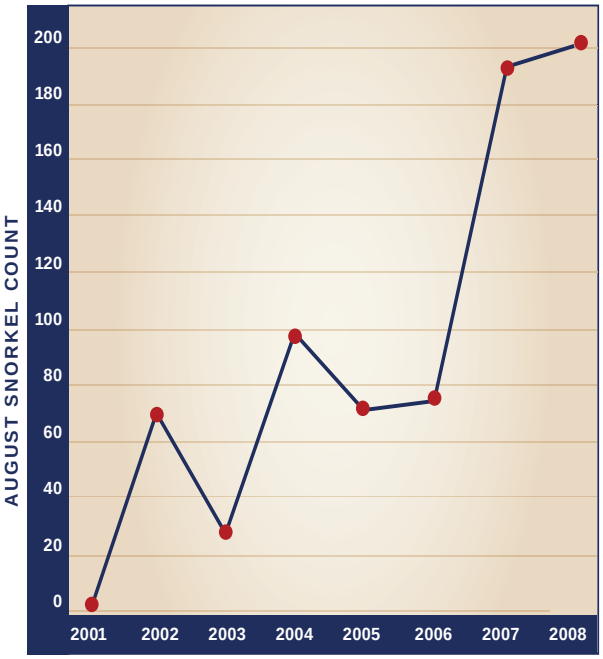


Figure 14. Adult Spring-Run Chinook Salmon Population, Clear Creek (2001-2008)

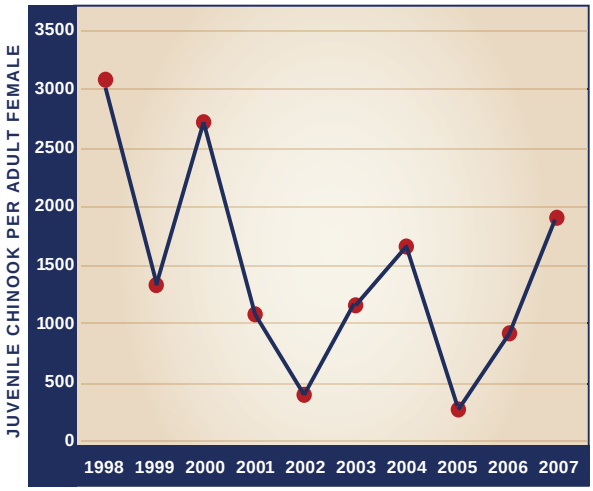


Figure 15. Juvenile Fall-Run Chinook Salmon Produced/Adult Female, Clear Creek (1998-2007)

from about 3,000 in 1998 to a low of 300 in 2005, as shown in Figure 15. These decreases are due in part to excessive amounts of fine sediment in the stream channel that could be removed by intermediate flows that would flush the sediment downstream. The Clear Creek Restoration Program is pursuing the use of flushing flows from the (b)(3) Water Acquisition Program to remove fine sediment from the stream channel. The pilot project would target flows of 3,250 cfs from the Whiskeytown gloryhole for one day.

Direct observation studies of the Phase 3A and Phase 3B restoration projects continued to indicate that overall both projects performed well at providing juvenile Chinook rearing habitat, although boulder clusters and one type of rootwad structure performed poorly.

New monitoring initiated in FY 2008 included benthic macro-invertebrate sampling to compare the effectiveness of the restoration projects, mercury sampling during storms to evaluate the impact of Phase 3B on total mercury in Clear Creek, and a riparian encroachment and restoration opportunity inventory that was later put on hold due to a shortage of Restoration Funds. This inventory will provide information to evaluate the need for further physical habitat restoration in Clear Creek.

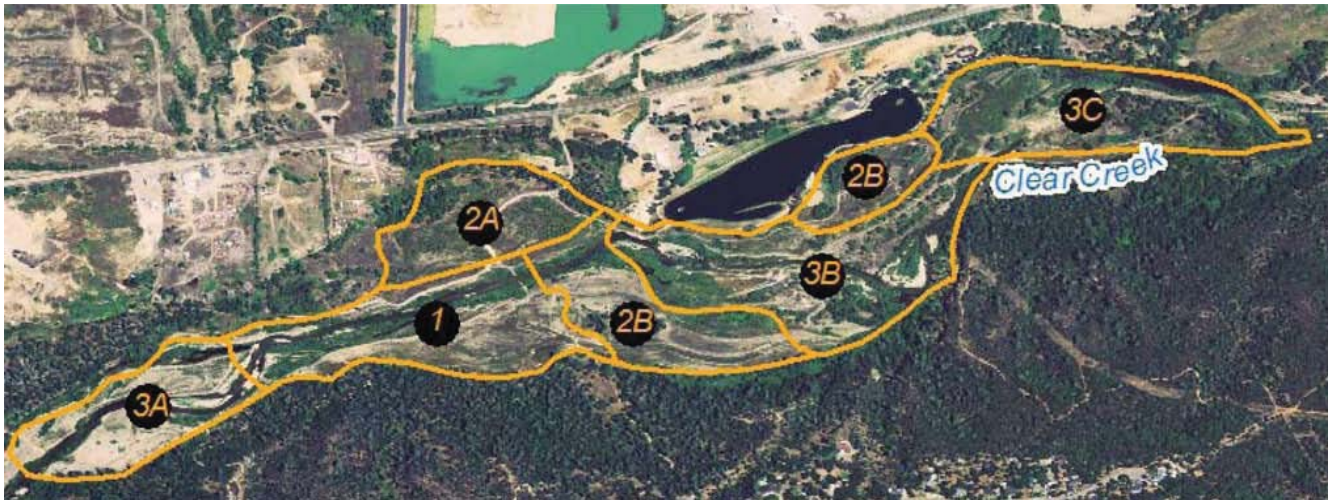


Figure 16. Clear Creek Channel Restoration Project Phases

Spawning and Rearing Habitat Restoration Program

FY 2008

Funding Obligation

$883,000 (Restoration Fund)

$878 (State)

Accomplishments

Sacramento River

- Purchased and placed approximately 8,300 tons of gravel

Stanislaus River

- Approximately 50% of spawning was in the Goodwin Canyon gravel placement area exceeding the program goal of 10% of spawning salmonids using the gravel placement
- Mapped Chinook redds on added gravel
- Surveyed topography of the three riffles created at Knights Ferry
- Mapped bathymetry of the river for planning future gravel projects

American River

- Redd density for Chinook and steelhead combined on the 2008 placed gravel was about 0.015 redds per square meter, near the program goal of 0.03 redds per square meter
- Egg retention in 2008 was ten percent, meeting the program goal
- Permitted for and placed 7,000 tons of spawning gravel at Sailor Bar
- Completed a gravel budget describing the amount of gravel blocked by Nimbus and Folsom Dams
- Completed gravel permeability studies
- Acquired aerial photography documenting Chinook spawning throughout the river
- Began testing and permitting to use gravel from historic mining operations along the river for future cost effective gravel enhancement
- Started testing and permitting of side channel restoration to improve rearing conditions for juvenile salmon and steelhead

CVPIA Section 3406(b)(13)

"Develop and implement a continuing program… to restore and replenish spawning gravel…and rearing habitat… on the American, Stanislaus and Sacramento Rivers…shall include preventive measures…"

The construction of Central Valley Project dams has had dramatic effects on the rivers in which they are placed; one effect is the prevention of rocks, gravel, dirt and other substrates from passing through them. Absent the dams, these materials would move into the river providing habitat needed for successful spawning and juvenile rearing. The (b)(13) program represents a continuous effort to restore spawning and rearing habitat, in the Upper Sacramento River from Keswick Dam to the Red Bluff Diversion Dam, in the American River downstream of Nimbus Dam and in the Stanislaus River downstream from Goodwin Dam.

The average annual gravel deficits on CVP streams are based on scientifically developed estimates for the amount of gravel that the dams retain:

- Sacramento River–50,000 cubic yards (65,000 tons)
- Stanislaus River–20,000 cubic yards (26,000 tons)
- American River–57,200 cubic yards (74,000 tons)

With gravel deficits of this magnitude and the cost of acquiring gravel, the program focuses on sites that are thought to have the most benefit to increase the quality and quantity of spawning and rearing habitat. The program goals are to annually place 10,000 tons in the Sacramento River, 3,000 tons in the Stanislaus River, and

Figure 17. Recent projects sites in the Sacramento, American, and Stanislaus rivers

7,000 tons in the American River. Two criteria guide the identification of gravel placement sites: the need for spawning habitat and accessibility to the river by truck, helicopter or sluice to deliver the gravel. All gravel is placed according to criteria developed by the DFG and NMFS. Figure 17 shows recent gravel placement locations.

Assessing Need

Aerial photos, redd surveys, snorkel surveys, and boat surveys are utilized to identify areas for augmentation. Spawning densities show that there are more anadromous fish than available spawning habitat. Future gravel placements are based on data from these surveys.

Once the gravel is placed, Reclamation and the Service monitor the spawning and rearing occurring at and near the restored sites to determine the program's effectiveness. The program monitors fish use, habitat suitability, and several other variables to help determine success.

Fish Use

The goal for the Sacramento River gravel placement areas is 25 percent of spawning salmonids using the gravel placement reach; the goal for the Stanislaus River gravel placement areas is 10 percent of spawning salmonids using the gravel placement sites. The goal for the American River is 0.03 redds per square meter on emplaced gravel and less than 10 percent egg retention.[1]

Since the program's implementation, monitoring has shown improvement (see below under measuring success) in spawning distribution relative to total escapement (Sacramento and Stanislaus rivers) and redd density per square meter (American River). Salmonids have been observed spawning on the gravel at each of the placement sites on the three rivers. Aerial photography and onsite ground surveys have documented the location of salmon redds and juvenile salmonids have been observed rearing in the vicinity of the gravel.

Habitat Suitability

The suitability of gravel for spawning is an important indicator used to determine future gravel placement actions. Ongoing gravel studies examine areas with new and old gravel to determine if the gravel has suitable; permeability for egg survival, size of gravel for making redds, depth for fish to utilize it and for redds to be fully submerged, and velocity to provide oxygen and other nutrients.

All gravel placements now utilize the data collected on the Stanislaus River in 2005 that determined the optimum size of gravel to create adequate permeability. The 2005 study compared man made riffles created with

Table 12. Total Gravel Placed (1997-2008)

River	Total Gravel Placed Since 1997 (Tons)	Gravel Placed in 2008 (Tons)	Annual Target (Tons)	Percent of Annual Target for 2008
Sacramento	168,300	8,300	10,000	83%
Stanislaus	14,100	0	3,000	0%
American	13,000	7,000	7,000	100%

[1] Egg retention refers to female salmon that die before before spawning. It is determined by cutting dead salmon open and examining the proportion of total eggs remaining (retained).

varying sizes of gravel and determined that survival (egg to fry) was best in the mixture with a smaller sized gravel component.

Measuring Success

Sacramento River

In the Sacramento River, salmon spawning increased from an average percentage of 6.9 percent of the Chinook population spawning in the gravel placement reach prior to CVPIA to an average percentage of 15.6 percent spawning in the area that gravel was added since CVPIA was enacted (1993-2005). These numbers mean that now a greater proportion of fish use the gravel placement area near the dam where water temperature is coolest. The ability of fish to spawn in areas with cooler water should enhance survival of the listed runs. River conditions were unsuitable for collecting spawning surveys in 2006 and 2007; therefore, redd survey data is not available. The program goal of 25 percent of spawning salmonids using the gravel placement reach has not been attained.

In 2008, approximately 8,300 tons of gravel (83% of annual target) were purchased and placed in the Sacramento River (Figure 18). The gravel was placed on the side of the river channel at the Salt Creek site. The gravel will be distributed naturally as high flow events occur in the river. Other accomplishments on the Sacramento River include: conducting substrate mapping of the river bottom, doing cross sections to examine channel evolution, and preparing a gravel budget for the river using a sediment transport model.

Figure 18. Sacramento River project completed after adding 8,300 tons of gravel

Stanislaus River

Accomplishments in the Stanislaus River included mapping Chinook redds on gravel added in past projects (Figure 19), topographic survey of three riffles created at Knights Ferry, and bathymetric mapping of the river (in cooperation with the Reclamation Central California Area Office) for planning future gravel projects. Chinook salmon escapement in the Stanislaus River was low in 2007. During November and December 2007 (FY 2008) approximately 50 percent of spawning was in the Goodwin Canyon gravel placement area so the program goal of 10 percent of spawning salmonids using the gravel placement was exceeded. Seven redds were mapped on the placement sites downstream at Knights Ferry. Data for 2008 is not yet available but use did not appear to be as high as in 2007.

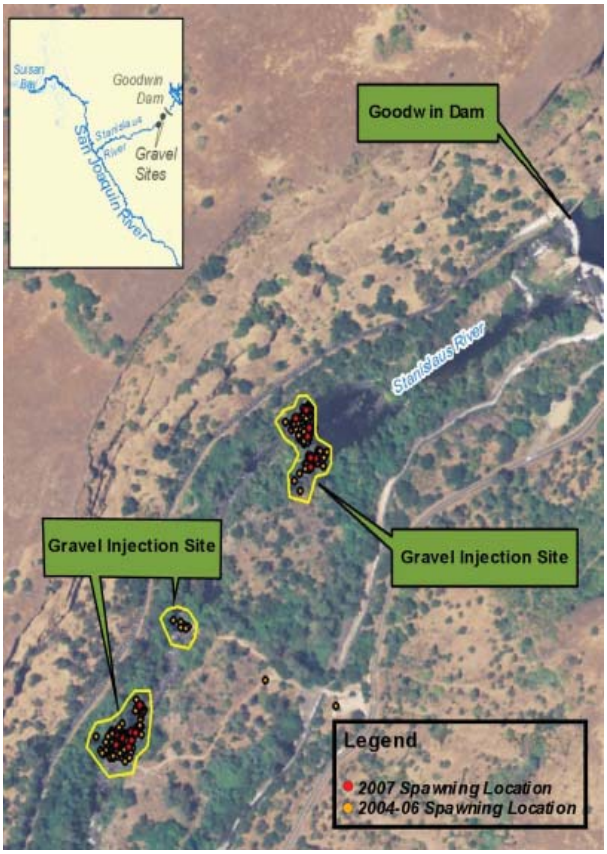


Figure 19. Spawning locations (dots) within gravel injection sites on the Stanislaus River

American River

Studies in the American River conducted in 2007 identified existing areas of overly high-density spawning by salmonids, indicating spawning habitat area limitations. The program used this data in FY 2008 to prioritize gravel placement to improve these conditions. Accomplishments in 2008 on the American River included the permitting and placement of 7,000 tons of spawning gravel (100 percent of annual target) at Sailor Bar (Figures 20 and 21), completion of a gravel budget describing the amount of gravel blocked by Nimbus and Folsom Dams, completion of gravel permeability studies, and acquisition of aerial photography documenting Chinook spawning throughout the river. Redd density for Chinook and steelhead combined on the 2008 placed gravel was about 0.015 redds per square meter (110 redds in 6,800 square meters of placed gravel), near the goal of 0.03 redds per square meter. Egg retention in 2008 was 10 percent, meeting the goal, although total Chinook escapement was the lowest ever recorded.

In 2008, the program began testing and permitting to use gravel from historic mining operations along the river for future cost effective gravel enhancement. Local gravel availability is low so utilizing on-site gravel sources can reduce the cost of projects. In 2008, the program also started testing and permitting side channel restoration to improve rearing conditions for juvenile salmon and steelhead.

Figure 20. American River Upper Sailor Bar (Pre-Project) note that the site is relatively flat water

Figure 21. American River Upper Sailor Bar (Post-Project) note the light gravel and the site formed a riffle, which is desirable spawning habitat

Head of Old River Barrier

FY 2008

Funding Obligation

None

Accomplishments

- Installed a seasonal, temporary rock barrier at the head of Old River
- Continued additional planning and environmental compliance work on the permanent operable fish gate

Temporary Head of Old River Barrier

CVPIA Section 3406(b)(15)

"Construct, in cooperation with the State of California and in consultation with local interests, a barrier at the head of Old River in the Sacramento-San Joaquin Delta to be operated on a seasonal basis to increase the survival of young outmigrating salmon that are diverted from the San Joaquin River to Central Valley Project and State Water Project pumping plants and in a manner that does not significantly impair the ability of local entities to divert water..."

The South Delta Improvement Program (SDIP) is a joint federal and state program that covers a series of proposed actions to improve water levels and water quality in the southern part of the Sacramento-San Joaquin Delta, protect salmon in the San Joaquin River, and improve water supply reliability for south of delta contractors and environmental uses.

In support of SDIP, to reduce the number of fall- and late fall-run Chinook salmon that enter the Old River and to reduce entrainment at the CVP and SWP export facilities, the CVPIA has authorized the construction of a permanent operable fish gate at the head of the Old River to keep young salmon in the San Joaquin River as they migrate to the ocean in the spring. In addition, a planned fish ladder at the head of Old River will give passage to those adult salmon entrained into delta channels to the spawning grounds in the San Joaquin River.

The three agricultural gates and limited dredging will protect water levels and water quality in the South Delta channels. Water levels are protected by keeping the gates open when the tide is coming in (flood) and

closing the gates to trap some of the tide at a specific elevation. Water quality is improved during periods of poor San Joaquin River water quality by the circulation of water caused by the gates' operation. After structural improvements (new operable gates, dredging and agricultural intake modifications) are complete, a supplemental EIS/EIR would be prepared to consider an increased permitted limit in the diversion rate at Clifton Court Forebay. This would increase the water deliveries to state and federal water contractors and for environmental uses south of the delta by improving the operational flexibility of the SWP Banks export facilities.

The (b)(15) target was to have a permanent operable gate designed, constructed, and operational by 2009. Unlike temporary gates, the permanent gate is expected to be 100 percent effective for salmon and can be in place and operable when San Joaquin River flows are high. In order to illustrate the benefits of the project's implementation, in 2007 Reclamation developed a conceptual model that shows the relationships between Chinook salmon and environmental factors occurring in the delta. The conceptual model describes the hypotheses regarding Chinook salmon migration periods and pathways and how key habitat factors (e.g., flow, temperature) and operations (e.g., Head of Old River Barrier, CVP and SWP pumping rates, salvage facilities) influence the survival of Chinook salmon juveniles in the lower San Joaquin River and delta. This model could be used in future funding appropriation decisions.

Although the Final EIS/EIR to study the potential impacts and benefits of the proposed SDIP was completed in December 2006 and the agencies have continued to move the project toward the construction and implementation phase, the issuance of the OCAP BO's by the Service and NMFS must occur prior to construction. The OCAP BO's cover the gate operations only; a separate BO for the construction effects is also required. The Service issued a BO on OCAP that includes gate operations. NMFS will issue a BO on OCAP in June 2009. As the NMFS BO is delayed, the construction target is now 2010.

In the absence of a permanent operable gate, the Head of Old River Barrier is closed with a temporary rock barrier from April 15 to May 15 to allow salmon smolts to stay in the San Joaquin River as they migrate out to the ocean. In October and November, the rock barrier is closed again to protect flows in the San Joaquin River, which helps to increase dissolved oxygen in the river and keep more of the returning adult salmon in the river.

Measuring Success

A seasonal, temporary rock barrier at the head of Old River has been installed for 12 of the 16 CVPIA years (1992-2008), helping to keep fish in the San Joaquin River. The temporary barrier was not installed in four years (1995, 1998, 1999, and 2005) due to high flows. Until the permanent gates are constructed, temporary barriers will continue to be placed to reduce salmonid fish losses, unless there is a conflict with the in-delta habitat flow requirements for delta smelt. Success of the permanent gates is measured based on completing three key stages, namely (1) planning and environmental compliance, (2) design, and (3) construction. The project completed most of the first stage in 2006 with the issuance of the Final EIS/EIR; additional planning and environmental compliance work is expected to continue through 2009.

Comprehensive Assessment and Monitoring Program

FY 2008

Funding Obligation

$291,000 (Restoration Fund)

Accomplishments

- Produced an annual report that quantifies the production of anadromous fish from the Central Valley and assesses progress toward the AFRP fish production targets
- Funded a cooperative agreement to develop statistical and structural design recommendations for a comprehensive database to document changes in the abundance of juvenile Chinook salmon in the Central Valley
- Updated the CAMP web site (www.fws.gov/sacramento/CAMP/index.htm) which functions as a resource for all reports and documents pertaining to CAMP, including the CAMP Implementation Plan, annual reports and data collected with CAMP funding

Weir installation for fish monitoring on the Stanislaus River

CVPIA Section 3406(b)(16)

"…Establish, in cooperation with independent entities and the State of California, a comprehensive assessment program to monitor fish and wildlife resources in the Central Valley to assess the biological results and effectiveness of actions implemented pursuant to this subsection…."

CAMP assesses progress toward the AFRP fish doubling goals, stated in section 3406 (b)(1), by monitoring natural production of adult anadromous fish in the Central Valley and comparing these data to AFRP production targets. CAMP activities focus on nine anadromous fish taxa: Chinook salmon (fall-, late-fall-, winter-, and spring-run), steelhead, striped bass, American shad, white sturgeon and green sturgeon.

CAMP primarily relies on other entities (e.g., the AFRP or DFG) to collect the information it analyzes and synthesizes. To the extent that funding is available, the program works with partners to provide partial funding to complete high-priority monitoring projects.

In 1997, a CAMP Implementation Plan was developed, and describes methods and procedures for: (1) monitoring anadromous fish species in California's Central Valley, and (2) assessing the biological results and effectiveness of different categories of restoration activities. The plan identifies 82 monitoring elements that are required to assess progress toward the AFRP fish doubling goals. Currently, 62 of these activities are being conducted, generally by entities outside of the program, such as the state and water districts (table 13). In 2004, the CAMP issued a contract to evaluate

statistical procedures for assessing progress toward the fish doubling goals and determining sustainability of production increases. The report resulting from the contract cited a need for better data, including watershed-specific escapement estimates for naturally spawned and hatchery fish; watershed-specific juvenile production estimates; and ocean, mainstem and tributary angler catches. Implementation of these recommendations is frequently constrained by the budgetary limitations of entities that collect data.

The CAMP has a single performance measure, which is to develop an annual report. Toward that end, the CAMP has produced several reports quantifying the abundance of anadromous fish species and tracking progress toward the AFRP fish doubling goals.

Measuring Success

CAMP has produced six annual reports since program inception. These documents were finalized in 1998, 1999, 2001, 2002, 2007, and 2008. Each report monitors the production of anadromous fish and assesses progress toward the AFRP fish production targets during different periods.

The 2008 annual report synthesizes and analyzes anadromous fish monitoring data collected between 1992 and 2007 on 21 watersheds. Because the process of collecting and reporting data is time consuming, data are only available for American shad and the four runs of Chinook salmon through 2007; and striped bass, green sturgeon, and white sturgeon through 2005. Figure 22 provides a graph depicting the natural production of four runs of Chinook salmon from 21 watersheds in the Central Valley; figures 23 and 24 show estimated abundance of white and green sturgeon in San Pablo Bay and Suisun Bay; figure 25 shows estimated abundance of adult striped bass in the Sacramento-San Joaquin River Delta; and figure 26 provides a graph depicting the midwater trawl index for young-of-the-year (YOY) American shad in the Sacramento-San Joaquin River Delta and San Pablo and Suisun Bays. Additional figures and data for striped bass, American shad, white sturgeon, green sturgeon, and individual runs of Chinook salmon from 1992 to 2007 are contained in the 2008 CAMP annual report posted on the CAMP web site. At the present time, a coordinated and comprehensive program for monitoring steelhead does not exist; however, a variety of entities are working to develop such a program.

Overall, the 2008 annual report concludes that the majority of the AFRP production targets have not been met on a regular basis, suggesting that a substantial increase in restoration efforts will be required to promote measurable increases in production of the above-mentioned nine anadromous fish taxa in order to achieve the AFRP production targets.

Concerns about low Chinook salmon numbers prompted an unprecedented closure of the ocean harvest of Central Valley Chinook salmon in 2008. The inland harvest of fall-run Chinook salmon in the Central Valley was also dramatically curtailed in 2008 to improve the likelihood that the number of salmon will increase in the future.

In FY 2008, CAMP funded a $45,341 cooperative agreement to develop statistical and structural design recommendations for a comprehensive database to document and understand changes in the abundance of juvenile Chinook salmon in the Central Valley.

In FY 2008, two of the 82 CAMP-recommended monitoring elements were completed with the assistance of CVPIA funds or staff. These include: (1) operation of a rotary screw trap in the Stanislaus River via a contract that was funded with CAMP and the Dedicated Project Yield program (3406(b)(2)) funds, and (2) operation of a rotary screw trap in the Merced River that was facilitated with AFRP (3406(b)(1)) staff and an AFRP-funded contract. Of the 80 other CAMP-recommended monitoring elements in FY 2008, 15 did not occur and the remaining 65 were conducted by other entities, e.g., DFG.

Program Planning & Evaluation

The CAMP currently is conducting an internal evaluation to determine the program's future scope, direction, and costs. The internal evaluation will:

- Review past and ongoing monitoring projects to identify data gaps;
- Quantify the cost for completing critical monitoring activities between 2008 and 2012;
- Identify partnerships CAMP should pursue to cooperatively fund projects where a partner may share a common interest; and

- Identify mechanisms for providing monitoring information to interested parties.

The results from the internal evaluation will be included in a programmatic document that updates the 1997 CAMP Implementation Plan. A completion deadline for the updated document has not yet been established.

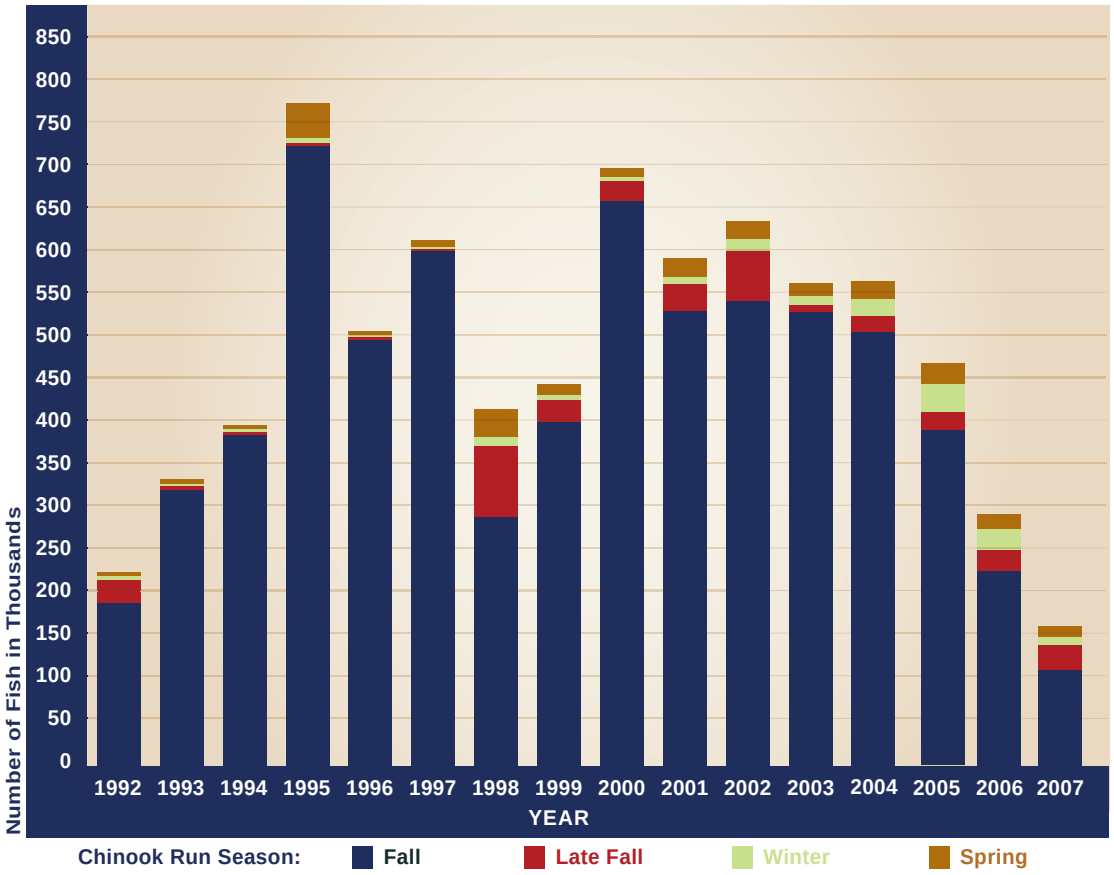


Figure 22. Estimated Total Natural Chinook Production, Central Valley (1992-2007)

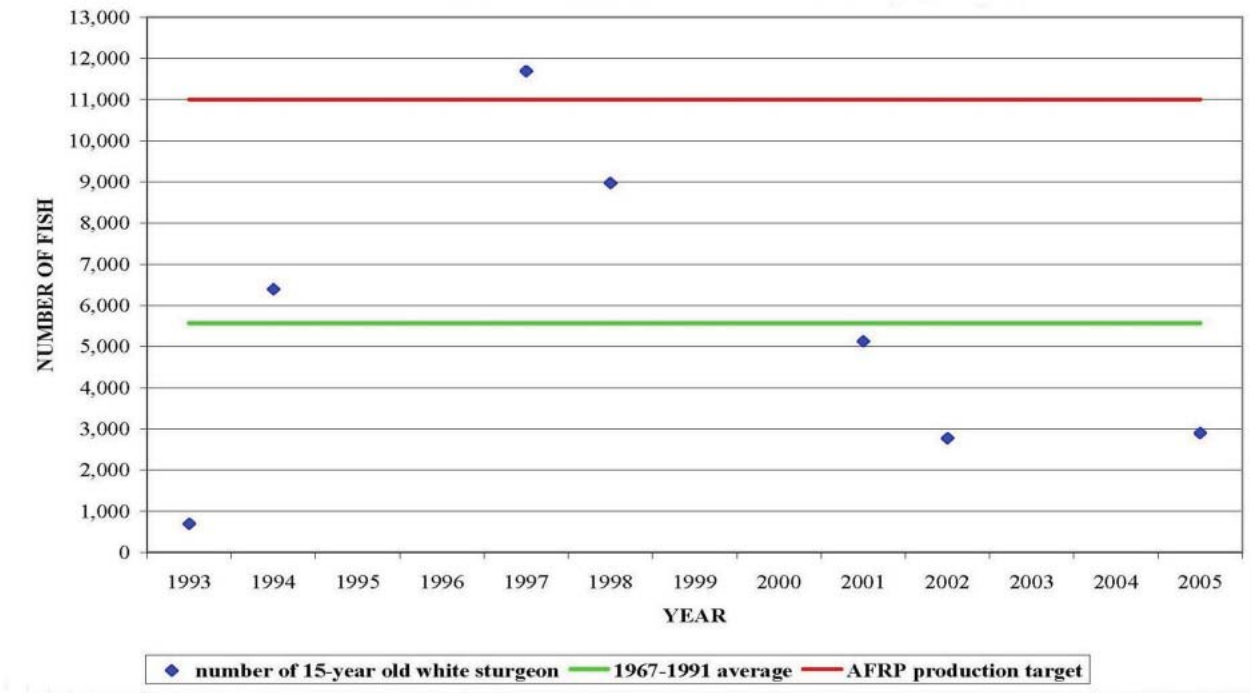


Figure 23. Estimated Abundance of 15-year-old White Sturgeon in San Pablo Bay and Suisun Bay, 1993-2005

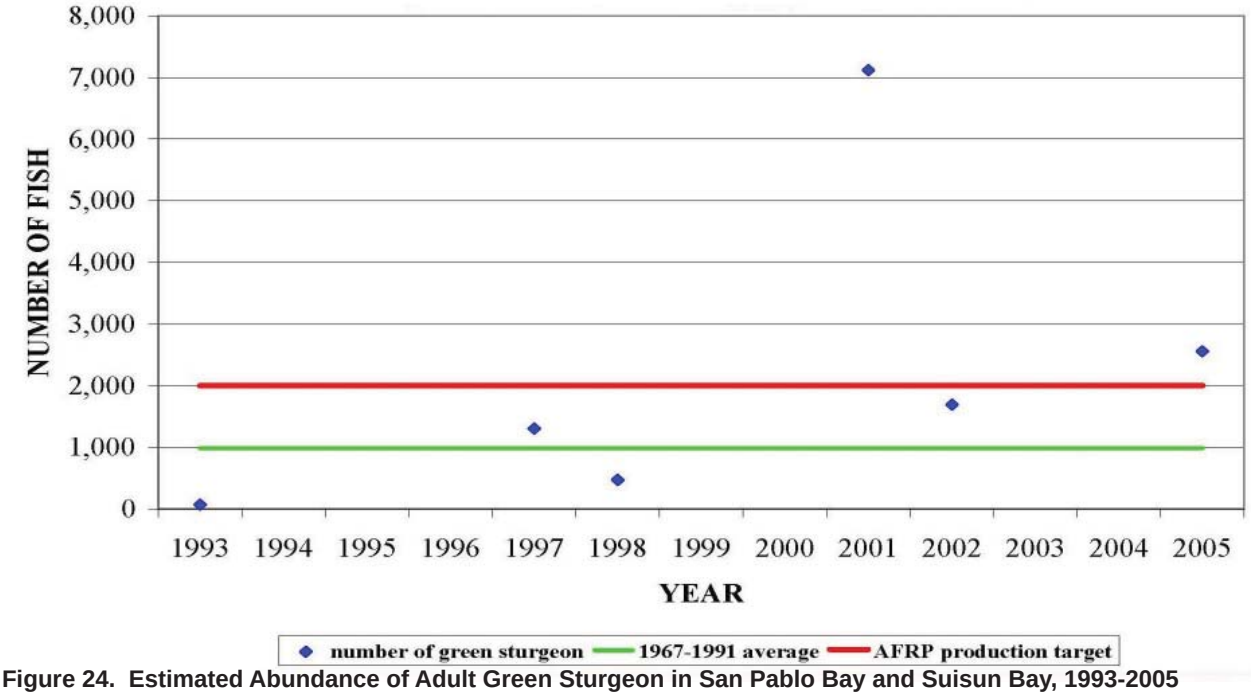


Figure 24. Estimated Abundance of Adult Green Sturgeon in San Pablo Bay and Suisun Bay, 1993-2005

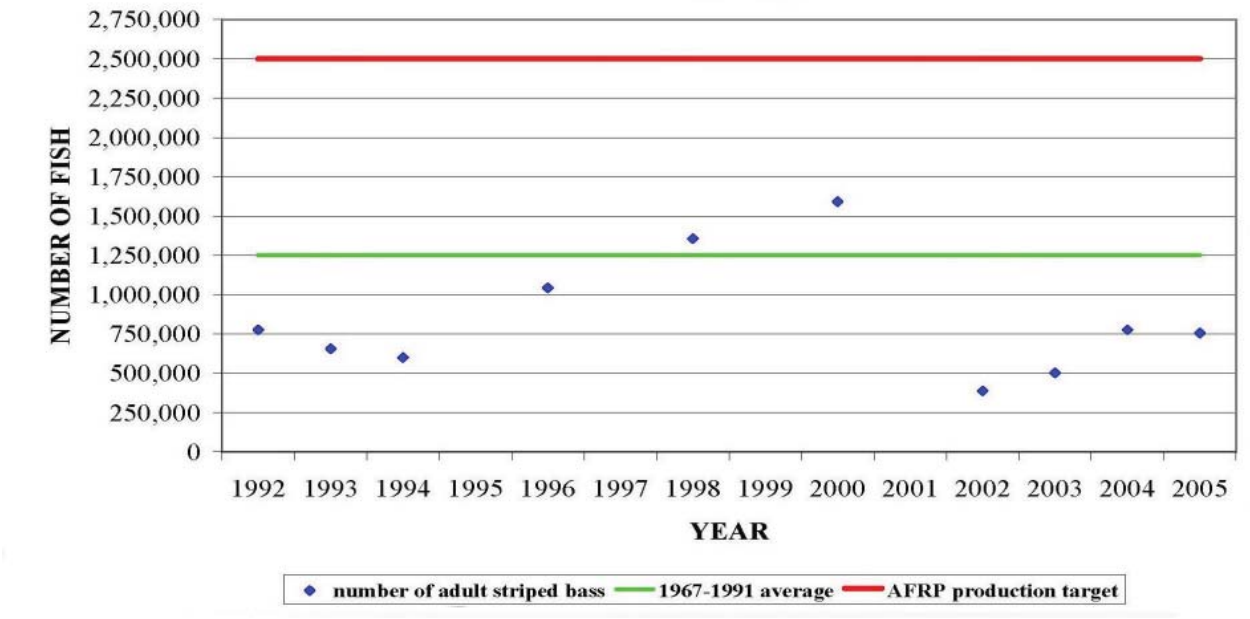


Figure 25. Estimated abundance of adult striped bass in the Sacramento-San Joaquin River Delta, Sacramento River downstream from the town of Colusa, and portion of the San Joaquin River downstream from the town of Mossdale, 1992-2005. 2002-2005 estimates only include male fish.

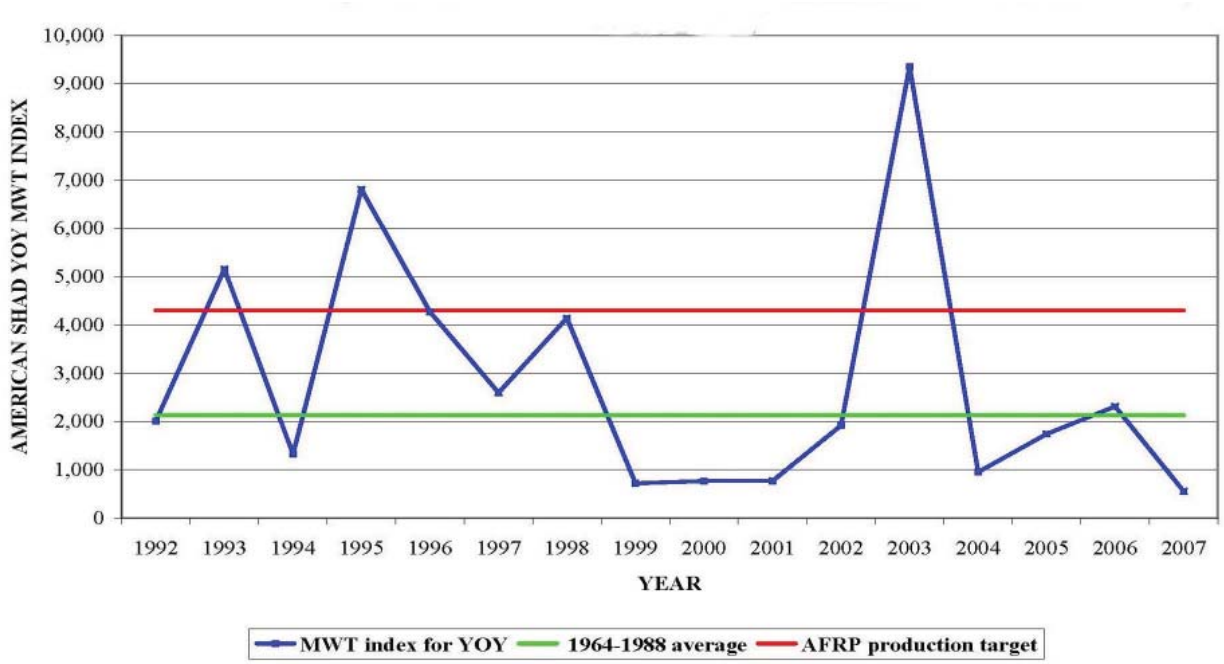


Figure 26. Midwater trawl index for YOY American shad in the Sacramento-San Joaquin River Delta and San Pablo and Suisun Bays, 1992-2007

Table 13. CAMP Recommended Monitoring Elements by Watershed

CAMP Element	Monitoring Method	Watershed	Species	Lead Agency
1	Carcass survey	American River	Fall-run Chinook salmon	DFG
2	Hatchery count	American River	Fall-run Chinook salmon	DFG
3	Hatchery marking	American River	Fall-run Chinook salmon	DFG
4	Angler survey	American River	Fall-run Chinook salmon	DFG
76	Rotary screw trap	American River	Fall-run Chinook salmon	DFG
65	Rotary screw trap	Battle Creek	Fall-run Chinook salmon	FWS
5	Video camera	Battle Creek	Fall-run Chinook salmon	FWS/DFG
6	Hatchery count	Battle Creek	Fall-run Chinook salmon	FWS
7	Hatchery marking	Battle Creek	Fall-run Chinook salmon	FWS
34	Carcass survey	Battle Creek	Late fall-run Chinook salmon	FWS/DFG
35	Hatchery count	Battle Creek	Late fall-run Chinook salmon	FWS
36	Hatchery marking	Battle Creek	Late fall-run Chinook salmon	FWS
51	Hatchery count	Battle Creek	Steelhead	FWS
52	Hatchery marking	Battle Creek	Steelhead	FWS
70	Rotary screw trap	Big Chico Creek	Fall-run Chinook salmon	DFG
71	Rotary screw trap	Big Chico Creek	Spring-run Chinook salmon	DFG
8	Carcass survey	Butte Creek	Fall-run Chinook salmon	DFG
72	Rotary screw trap	Butte Creek	Fall-run Chinook salmon	DFG
45	Snorkel survey	Butte Creek	Spring-run Chinook salmon	DFG
73	Rotary screw trap	Butte Creek	Spring-run Chinook salmon	DFG
9	Carcass survey	Clear Creek	Fall-run Chinook salmon	DFG
64	Rotary screw trap	Clear Creek	Fall-run Chinook salmon	FWS
10	Carcass survey	Deer Creek	Fall-run Chinook salmon	DFG
68	Rotary screw trap	Deer Creek	Fall-run Chinook salmon	DFG
46	Snorkel survey	Deer Creek	Spring-run Chinook salmon	DFG
69	Rotary screw trap	Deer Creek	Spring-run Chinook salmon	DFG
11	Carcass survey	Feather River	Fall-run Chinook salmon	DWR
12	Hatchery count	Feather River	Fall-run Chinook salmon	DFG
13	Hatchery marking	Feather River	Fall-run Chinook salmon	DWR
14	Angler survey	Feather River	Fall-run Chinook salmon	DFG
74	Rotary screw trap	Feather River	Fall-run Chinook salmon	DWR
82	Hatchery marking	Feather River	Spring-run Chinook salmon	DWR
15	Carcass survey	Merced River	Fall-run Chinook salmon	DFG
16	Hatchery count	Merced River	Fall-run Chinook salmon	DFG
17	Hatchery marking	Merced River	Fall-run Chinook salmon	DFG
81	Angler survey	Merced River	Fall-run Chinook salmon	DFG
80	Rotary screw trap	Merced River-Hagaman County Park	Fall-run Chinook salmon	FWS
18	Carcass survey	Mill Creek	Fall-run Chinook salmon	DFG
66	Rotary screw trap	Mill Creek	Fall-run Chinook salmon	DFG
47	Redd survey	Mill Creek	Spring-run Chinook salmon	DFG
67	Rotary screw trap	Mill Creek	Spring-run Chinook salmon	DFG
19	Ladder count	Mokelumne River	Fall-run Chinook salmon	EBMUD
20	Hatchery count	Mokelumne River	Fall-run Chinook salmon	DFG
21	Hatchery marking	Mokelumne River	Fall-run Chinook salmon	DFG/EBMUD
22	Angler survey	Mokelumne River	Fall-run Chinook salmon	DFG
77	Rotary screw trap	Mokelumne River	Fall-run Chinook salmon	EBMUD

Table 13. CAMP Recommended Monitoring Elements by Watershed (continued)

CAMP Element	Monitoring Method	Watershed	Species	Lead Agency
23	Ocean harvest	Pacific Ocean	Fall-run Chinook salmon	DFG
39	Ocean harvest	Pacific Ocean	Late fall-run Chinook salmon	DFG
50	Ocean harvest	Pacific Ocean	Spring-run Chinook salmon	DFG
44	Ocean harvest	Pacific Ocean	Winter-run Chinook salmon	DFG
55	Midwater trawl survey	Sacramento-San Joaquin River Delta	American shad	DFG
57	Mark-recapture	Sacramento-San Joaquin River Delta	Green sturgeon	DFG
54	Mark-recapture	Sacramento-San Joaquin River Delta	Striped bass	DFG
56	Mark-recapture	Sacramento-San Joaquin River Delta	White sturgeon	DFG
25	Carcass survey	Sacramento River	Fall-run Chinook salmon	DFG
26	Aerial redd count	Sacramento River	Fall-run Chinook salmon	DFG
27	Angler survey	Sacramento River	Fall-run Chinook salmon	DFG
37	Aerial redd count	Sacramento River	Late fall-run Chinook salmon	DFG
38	Angler survey	Sacramento River	Late fall-run Chinook salmon	DFG
49	Angler survey	Sacramento River	Spring-run Chinook salmon	DFG
53	Angler survey	Sacramento River	Steelhead	DFG
40	Hatchery marking	Sacramento River	Winter-run Chinook salmon	FWS
41	Carcass survey	Sacramento River	Winter-run Chinook salmon	DFG
42	Aerial redd count	Sacramento River	Winter-run Chinook salmon	DFG
62	Rotary screw trap	Sacramento River/Glenn-Colusa Irrigation Diversion	Fall-run Chinook salmon	DFG
63	Rotary screw trap	Sacramento River/Glenn-Colusa Irrigation Diversion	Spring-run Chinook salmon	DFG
61	Rotary screw trap	Sacramento River/Glenn-Colusa Irrigation Diversion	Winter-run Chinook salmon	DFG
24	Ladder count	Sacramento River-Red Bluff Diversion Dam	Fall-run Chinook salmon	FWS
59	Rotary screw trap	Sacramento River-Red Bluff Diversion Dam	Fall-run Chinook salmon	FWS
48	Ladder count	Sacramento River-Red Bluff Diversion Dam	Spring-run Chinook salmon	FWS
60	Rotary screw trap	Sacramento River-Red Bluff Diversion Dam	Spring-run Chinook salmon	FWS
43	Ladder count	Sacramento River-Red Bluff Diversion Dam	Winter-run Chinook salmon	FWS
58	Rotary screw trap	Sacramento River-Red Bluff Diversion Dam	Winter-run Chinook salmon	FWS
28	Angler survey	San Joaquin River	Fall-run Chinook salmon	DFG
29	Carcass survey	Stanislaus River	Fall-run Chinook salmon	DFG
30	Angler survey	Stanislaus River	Fall-run Chinook salmon	DFG
78	Rotary screw trap	Stanislaus River-Caswell State Park	Fall-run Chinook salmon	FWS
31	Carcass survey	Tuolumne River	Fall-run Chinook salmon	DFG
79	Rotary screw trap	Tuolumne River - lower river	Fall-run Chinook salmon	Turlock Irrigation District
32	Carcass survey	Yuba River	Fall-run Chinook salmon	DFG
33	Angler survey	Yuba River	Fall-run Chinook salmon	DFG
75	Rotary screw trap	Yuba River	Fall-run Chinook salmon	DFG

Glenn-Colusa Irrigation District Program

FY 2008

Funding Obligation

$71,000 (Water & Related)

Accomplishments

- Completed the biological and hydraulic testing and monitoring program that began in 2001
- Completed hydraulic testing and a set of underwater observations of predator distributions
- The project and related testing and monitoring is 100 percent complete

Glenn-Colusa Irrigation District Fish Screen

CVPIA Section 3406(b)(20)

"Participate with the State of California and other federal agencies in the implementation of the on-going program to mitigate fully for the fishery impacts associated with operations of the Glenn-Colusa Irrigation District's Hamilton City Pumping Plant. Such participation shall include replacement of the defective fish screens and fish recovery facilities associated with the Hamilton City Pumping Plant…"

In the 1980s it was determined that the operation of the Glenn-Colusa Irrigation District (GCID) Pumping Plant was inadvertently trapping small fish in the intake channel due to the high pumping velocity and that modifications to the existing fish screens were required. The program installed additional screening mechanisms and modified the intake and discharge channels to improve hydraulic conditions for returning fish to the river. These interim measures allowed GCID to continue to pump part of its water allocation while screening and bypassing back to the Sacramento River up to 20 million juvenile salmon and other species per year.

Following a lengthy design, environmental analysis, and permitting process that spanned more than 10 years, construction began in the spring of 1998 on the retrofit and extension of the existing fish screen and modifications to the open channel. A replacement water control structure and access bridge was completed just downstream from the fish screen structure. Construction of all features was completed in spring 2001; to determine if the facility is operating per the design criteria, biological and hydraulic testing has been ongoing.

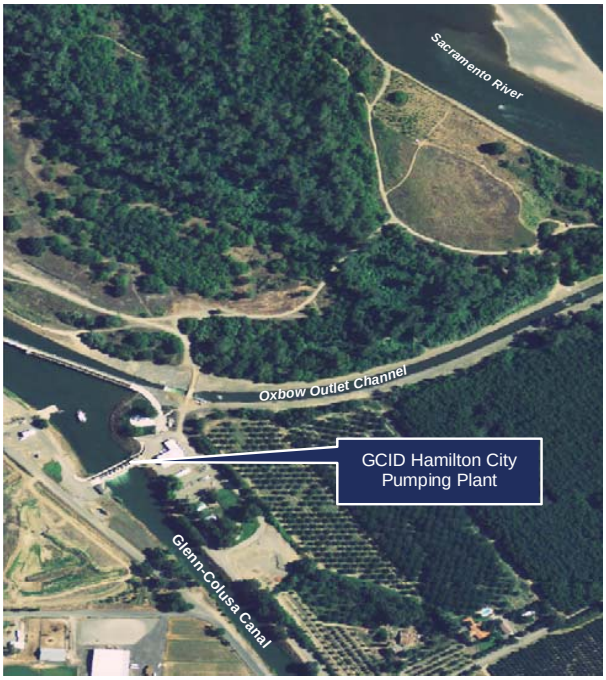


Figure 27. Glenn-Colusa Irrigation District Pumping Plant

Measuring Success

Mitigating Project Impacts

The biological and hydraulic testing and monitoring program of the screen system started in summer 2001. To date, the testing program has not found any fish loss attributed to the operation of the fish screen system.

The primary impact on terrestrial species involved the federally–listed valley elderberry longhorn beetle. Beetle habitat existed adjacent to the pumping plant and would likely have been affected by the construction. Mitigation was accomplished by transplanting 211 elderberry shrubs from the fish screen construction area to 29 acres of land purchased in fee for the Service along the river. The program also planted 6,718 elderberry bush associate plants to mimic natural riparian habitat conditions, and is providing 10 years of maintenance and monitoring on the adjacent site to ensure survival of all species. The Service has accepted the mitigation areas and will incorporate them into an existing refuge.

2008 Accomplishments

The principal effort in 2008 was completing the biological and hydraulic testing and monitoring program that began in 2001. Challenges to completing the program included problems with designing, building, and operating a facility to capture a sufficient amount of test fish; obtaining suitable small Chinook fry during the important summer test times; tagging salmon fry from Coleman Fish Hatchery; distinguishing between losses due to predators and any losses due to the new fish screen and bypass system; and measuring the approach velocity at the screen face.

As of FY 2008, the project and related testing and monitoring is 100 percent complete. Hydraulic testing and a set of underwater observations of predator distributions were completed in 2008. The completed facility screens up to 105,000 acre-feet of firm annual water supply to 20,000 acres of Sacramento National Wildlife Refuge lands.

Anadromous Fish Screen Program

FY 2008

Funding Obligation

($1,310,000) (Restoration Fund)

($3,144,000) (Water & Related)

($178,433) (State)
Amounts in ( ) = credit amount
Credit amounts are due to deobligations being larger than current year obligations

Accomplishments

- Completed construction of the RD 108 Emery Poundstone Pumping Plant Fish screen Project consolidating three existing unscreened diversions totaling 377 cfs into a new screened 300 cfs diversion on the Sacramento River
- Initiated construction of the Phase I Meridian Farms Fish Screen Project to screen 35 cfs at the New Grimes Diversion
- Initiated a four-year screening and monitoring program on the Sacramento River in partnership with CALFED ERP and the Family Water Alliance. Activities included conducted public outreach, site selection and permitting activities.
- Continued to provide technical assistance for on-going AFSP projects including Natomas Mutual, RD 2035, Patterson ID and Yuba City fish screens

RD 108 Emery Poundstone Pumping Plant Fish Screen Project

CVPIA Section 3406(b)(21)

"Assist the State of California in efforts to develop and implement measures to avoid losses of juvenile anadromous fish...measures shall include but shall not be limited to construction of screens on unscreened diversions, rehabilitation of existing screens, replacement of existing non-functioning screens, and relocation of diversions to less fishery-sensitive areas."

The AFSP assists the State of California in efforts to develop and implement measures, including construction, replacement, and rehabilitation of fish screens and relocation of diversions, to protect juvenile Chinook salmon, steelhead trout and green and white sturgeon from entrainment at priority water diversions throughout the Central Valley and Sacramento-San Joaquin Delta. The AFSP actions contribute to the goal defined in CVPIA Section 3406(b)(1), which requires Interior to make all reasonable efforts to double natural production of anadromous fish in the Central Valley streams.

To date, the AFSP has assisted the state in screening 24 diversions ranging from 17 cfs to 960 cfs for a cumulative total of more than 4,500 cfs (Table 14).

Currently, there are approximately 4,560 remaining unscreened diversions, including:

- Approximately 750 in the Sacramento River system
- Approximately 950 in the San Joaquin River system

Table 14. AFSP Projects and cfs Screened, Central Valley (1992-2008)

	Project Completed	Project Location*	CFS Screened (Annual)	Number of Projects (Annual)
1992-1995	N/A	N/A	0	0
1996	Pelger Mutual Water Company	Sacramento River	40	1
	Wilson Ranch	Sacramento River	40	1
1997	Suisun Resource Conservation District	Suisun Marsh	93	5
	Maxwell ID	Sacramento River	100	1
	Parrot-Phelan (M&T)	Sacramento River	150	1
1998	Western Canal	Butte Creek	siphon	1
1999	Browns Valley ID	Yuba River	65	1
	Gorrill Land Company	Butte Creek	122	1
	Adams Ranch (Rancho Esquon)	Butte Creek	135	1
	RD 1004	Sacramento River	290	1
	Princeton-Cordora Glenn & Provident ID	Sacramento River	605	1
2000	Dayly Lee	Steamboat Slough	20	1
	RD 108 (Wilkins Slough)	Sacramento River	832	1
2001	N/A	N/A	0	0
2002	N/A	N/A	0	0
2003	Lower Butte Creek (Wier #3)	Butte Creek (Sutter Bypass)	fish ladders & barriers	1
2004	Fairbairn (City of Sacramento)	American River	210	1
	Banta Carbona	San Joaquin River	260	1
2005	Sacramento River WTP (City of Sacramento)	Sacramento River	245	1
2006	RD 999	Sacramento River	100	1
2007	Sutter Mutual	Sacramento River	960	1
2008	RD 108 (Emery Poundstone)	Sacramento River	300	1
TOTAL			**4,567**	**24**

* See Figure 28

- Approximately 2,500 in the Sacramento-San Joaquin Delta
- Approximately 360 in the Suisun Marsh basin

Currently a long-term implementation plan is being developed for CVPIA that will identify priority restoration actions including fish screens; therefore, the exact number of screens to be constructed in the future has not yet been defined.

The AFSP provides assistance to the state by matching state funding. The AFSP can provide up to 50 percent of the cost of a fish screen project. In recent years, state funding for fish screens has come through the CALFED Ecosystem Restoration Program. The AFSP also provides technical support to a diverter during the planning, design, and construction phases of a fish screen project.

Measuring Success

In 2008, construction was completed on the Reclamation District (RD) 108 Emery Poundstone Pumping Plant Fish Screen Project in Sutter County. This project consolidated three existing unscreened diversions totaling 377 cfs into a new screened 300 cfs diversion on the Sacramento River. The AFSP provided a total of $15 million over the life of the project. This fish screen project protects out-migrating spring-, fall- and winter-run Chinook salmon and Central Valley steelhead as well as resident game and non-game fish from entrainment. Operation and maintenance of the fish screen is the responsibility of RD 108.

In 2008, construction was initiated on the Phase I Meridian Farms Fish Screen Project consisting of the screening of a 35 cfs diversion at the New Grimes Diversion.

In 2008, the AFSP continued to provide technical assistance (design, environmental and/or permitting) for several large fish screen projects which have not yet secured full construction funding, including:

- Natomas Mutual: Project to consolidate five diversions totaling 630 cfs into two screened diversions on the Sacramento River
- Patterson Irrigation: Project to screen a 190 cfs diversion on the San Joaquin River
- RD 2035: Project to screen a 400 cfs diversion on the Sacramento River
- City of Yuba City Fish Screen: Project to screen a 61 cfs municipal diversion on the Feather River

In 2008, the AFSP initiated a four-year screening and monitoring program in partnership with CALFED ERP and the Family Water Alliance. The AFSP is implementing this program to assess the biological benefits of fish screening and to help prioritize future fish screening efforts. This program, which includes collection of fish loss data prior to installing fish screens, is focused on the Sacramento River. Activities conducted for this monitoring program in 2008 included public outreach, site selection, and permitting.

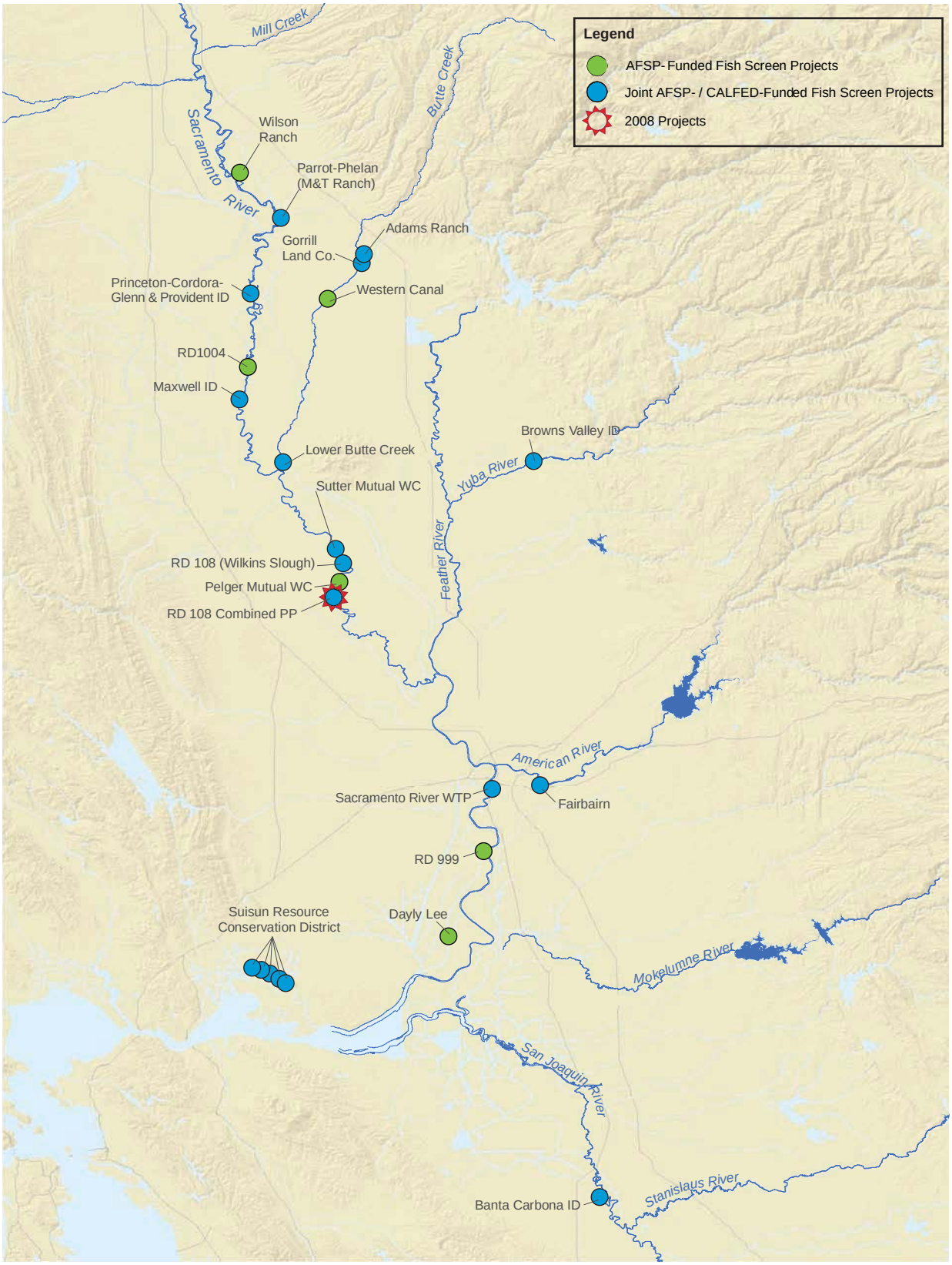


Figure 28. CVPIA Fish Screens Constructed (1992-2008)

San Joaquin River Comprehensive Plan

FY 2008

Funding Obligation

$7,733,000 (Restoration Fund)

Accomplishments

- Began development of specific operational guidelines for releasing Restoration Flows and the framework for a Recovered Water Account
- Began development of a plan to recirculate water back to the Friant Division long-term contractors
- Began development of a Fisheries Management Plan that incorporates an adaptive management approach

San Joaquin River

CVPIA Section 3406(c)(1)

"The Secretary shall . . . develop a comprehensive plan which is reasonable, prudent, and feasible to address fish, wildlife, and habitat concerns on the San Joaquin River, including but not limited to the streamflow, channel, riparian habitat, and water quality improvements that would be needed to reestablish where necessary and to sustain naturally reproducing anadromous fisheries from Friant Dam to its confluence with the San Francisco Bay/Sacramento-San Joaquin Delta Estuary."

The San Joaquin River is a major tributary to the Sacramento-San Joaquin Delta, historically providing flows from the southern Central Valley. Section 3406(c)(1) mandates the preparation of a reasonable, prudent and feasible comprehensive plan to reestablish and sustain naturally reproducing salmon in the San Joaquin River below Friant Dam to the confluence with the Sacramento-San Joaquin Delta Estuary.

The San Joaquin River Restoration Program

Federal Authorization and Legislation

The San Joaquin River Restoration Program (SJRRP) is currently authorized under the CVPIA and the agencies responsible for the management of the program include Reclamation, the Service, NMFS, DWR, and DFG.

Authorizing legislation to fully implement the SJRRP, known as the San Joaquin River Restoration Settlement Act (Act), passed the full Senate on January 15, 2009,

and is headed to the House of Representatives for a vote before being submitted to the President for signature. The legislation was reintroduced as part of the Omnibus Public Land Management Act, Senate Bill 22, by Senator Jiff Bingaman (NM) on January 7, 2009. Revised in late 2008 to include further water management and landowner protections, the Act is supported by the parties to the Settlement (Settling Parties) and downstream water and land interests (referred to as Third Parties).

While authorization is still pending at the time of this 2008 Annual Report, the Department of the Interior is proceeding with environmental review based on current authorities and funding, although timely passage of Congressional legislation will be critical to implementing provisions in the Settlement and maintaining the schedule.

Measuring Success

In 2007, many organizational and managerial actions were completed to form the long-term structure for the SJRRP. In 2008, significant progress was made towards supporting the development of the Program Environmental Impact Statement/Report (PEIS/R). Specific accomplishments in 2008 include:

- Progress on the development of specific operational guidelines for releasing Restoration Flows and the framework for a Recovered Water Account
- Progress on development of a plan to recirculate water back to the Friant Division long-term contractors
- Planning, coordinating, and implementing monitoring activities
- Completion and public release of draft Technical Memoranda
- Providing public access to Program activities through the web, quarterly Program Updates mailed to a broad distribution list, public meetings, and briefings at local forums
- Providing an on-the-ground tour from Friant Dam to the confluence of the Merced River through the Water Education Foundation specific to the SJRRP
- Substantial progress on the development of a Fisheries Management Plan (FMP) that incorporates an adaptive management approach. Specific accomplishments on the FMP include:
    - Draft documents completed during 2008 that form the basis of the integrated FMP include temporal occurrence and environmental requirements tables that are used to identify habitat suitability and physical requirements of the various Chinook salmon life stages, and conceptual models of spring-run and fall-run Chinook salmon that identify the groups conceptual understanding of the factors expected to limit the Chinook salmon population in the San Joaquin River.
    - Selection of a quantitative modeling tool (Ecosystem Diagnosis and Treatment) to assist with the development of the FMP and initial work in constructing the model.
    - Collaboration between a public Technical Feedback group and the Fisheries Management Work Group to gather comments and receive feedback from technical experts regarding the FMP.

Introduction to the Refuge Water Supply Program

CVPIA Section 3406(d)(1), (2), and (5)

"(d)(1)Upon enactment of this title, the quantity and delivery schedules of water measured at the boundaries of each wetland habitat area described in this paragraph shall be in accordance with Level 2 of the "Dependable Water Supply Needs" table for those habitat areas as set forth in the Refuge Water Supply Report and two-thirds of the water supply needed for full habitat development for those habitat areas identified in the "San Joaquin Basin Action Plan/Kesterson Mitigation Action Plan Report…"

"(d)(2) Not later than ten years after enactment of this title, the quantity and delivery schedules of water measured at the boundaries of each wetland habitat area described in this paragraph shall be in accordance with Level 4 of the "Dependable Water Supply Needs" table for those habitat areas as set forth in the "Refuge Water Supply Report" and the full water supply needed for full habitat development for those habitat areas identified in the "San Joaquin Basin Action Plan/Kesterson Mitigation Action Plan Report..."

"(d)(5) The Secretary is authorized and directed to construct or to acquire from non-Federal entities such water conveyance facilities, conveyance capacity, and wells as are necessary to implement the requirements of this subsection; provided, that such authorization shall not extend to conveyance facilities in or around the Sacramento-San Joaquin Delta Estuary..."

The Refuge Water Supply Program (RWSP) encompasses several CVPIA provisions such as Water Acquisition, Conveyance, and Construction:

Water Acquisition

- (b)(3) Water Acquisition Program (WAP) for acquisition of Incremental Level 4 quantities specified in (d)(2)

Conveyance

- (d)(1), (2) & (5) Refuge Conveyance (wheeling)–delivery of Level 2 water and Incremental Level 4 water

Construction

- (d)(5) Refuge Facilities Construction–specific facilities construction to support delivery of water to those lands identified in the Report on Refuge Water Supply Investigations March 1989 report; and
- (d)(5) San Joaquin Basin Action Plan–specific facilities construction to support delivery of water to the lands specified in the San Joaquin Basin Action Plan Lands/Kesterston Mitigation Plan December 1989 report

The RWSP's goal is to ensure that all wetland habitat areas, hereinafter referred to as refuges, annually receive water of specified quantity and suitable flow rate and quality to support their wetland and aquatic environments. The program serves 19 refuges as shown in Figure 29. The RWSP provisions (acquisition, conveyance, and construction) work together to implement these CVPIA provisions.

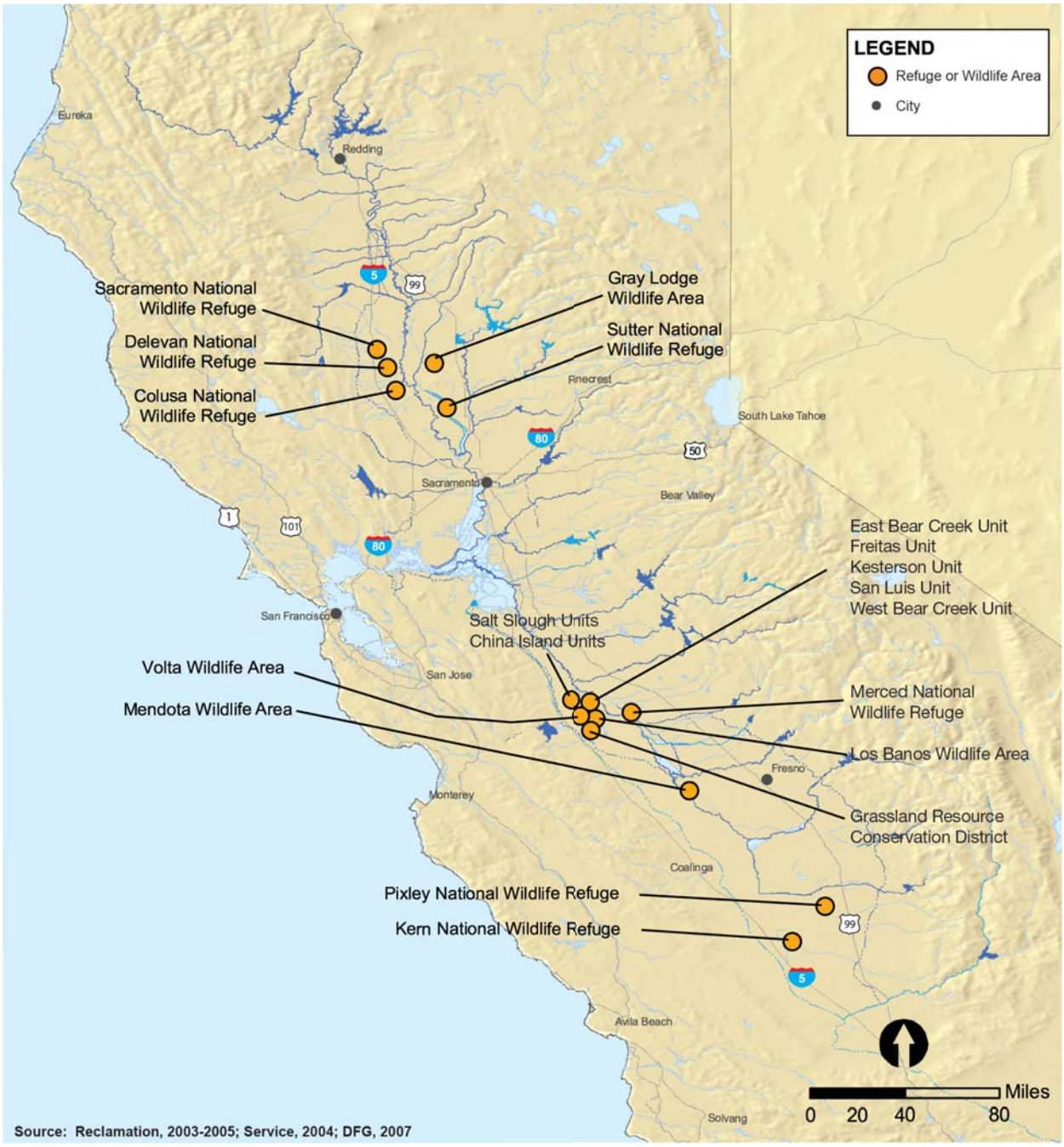


Figure 29. Central Valley Refuges Receiving CVPIA Water Supplies

The specified water quantities are defined as Level 2 water, Incremental Level 4 water, and Full Level 4 water (Table 15).

Level 2 is a specified amount of water required for minimum wetlands and wildlife habitat management, based on historic annual deliveries before 1989. Reclamation is required to provide full Level 2 water annually, either from the CVP yield or from other sources based on preexisting contracts or similar arrangements. Most Level 2 water is provided from the yield of CVP water. Some Level 2 water is provided from other non-CVP sources. The Level 2 annual water delivery target is 396,244 acre-feet.

Full Level 4 is the total annual amount of water identified for each refuge in CVPIA as required for optimum wetlands and wildlife habitat development and management. The Full Level 4 water delivery target for the 19 refuges is 555,515 acre-feet.

Incremental Level 4 water is the difference between Level 2 and Full Level 4 (159,271 acre-feet). Each year, Reclamation strives to provide as much Incremental Level 4 water as possible. The CVPIA specifies that

Reclamation must acquire this Incremental Level 4 water supply through voluntary measures such as water conservation, conjunctive use, purchase, lease, donation, or similar activities.

Level 2 and Full Level 4 allocation numbers were derived from two reports titled "*Report on Refuge Water Supply Investigations March 1989*" and "S*an Joaquin Basin Action Plan/Kesterson Mitigation Plan December 1989*" published by Interior and incorporated into CVPIA by reference. These studies collated all existing information on current and desired water use, power needs, surface water delivery systems, groundwater availability, recreation, and wildlife resources, and habitat management objectives for all of the refuges. Based on this information, alternative plans were formulated for each refuge to provide dependable water supplies, utilizing several water delivery "options," including Level 2 and Level 4.

Table 16 shows the Level 2 and Incremental Level 4 amounts of water allocated to each refuge according to the 1989 reports. Allocations under the refuge water supply contracts between Reclamation and refuge management agencies vary somewhat between Level 2 and Incremental Level 4 amounts, and this is footnoted in Tables 15 and 16. However, the total Level 4 allocations for each refuge remains the same.

Long-term supply contracts provide stability for refuge operators

To ensure reliability for refuge operators, Reclamation entered into long-term water supply contracts with the three refuge managing agencies: DFG, the Service, and Grassland Water District (GWD). These contracts have a performance period of 25 years and are renewable, representing Reclamation's commitment under CVPIA to provide sufficient water for wetlands and aquatic habitats.

Each year in February or March and monthly thereafter, Reclamation's Central Valley Operations Office announces the water supply available to the CVP contractors for the current year, including the amount of Level 2 water available out of the yield of the CVP for the refuges. The Interagency Refuge Water Management Team then establishes the water delivery schedule for both Level 2 water and Incremental Level 4 water for each refuge. This team is comprised of representatives from Reclamation, the Service, DFG, and GWD. The creation of this team was established through a provision in the long-term water supply contracts.

Use of groundwater for refuge water supplies

Availability of surface water supplies on the open market from willing sellers is limited in some years, leaving the RWSP unable to meet its Incremental Level 4 acquisition goals. The RWSP is attempting to expand its current diversification of sources of water to meet the needs of the refuges in the absence of sufficient funding for water acquisition. For example, the RWSP has pursued groundwater projects in partnership with local water districts. The primary advantage of groundwater is that usually it does not require external conveyance if the groundwater sources can be located at or near the refuges. The lower cost of groundwater is also an advantage, although one downside is that in some locations groundwater has poorer quality, particularly in the San Joaquin Valley. It is critical to monitor groundwater quality so as not to degrade the general quality of water on the refuges.

The Pixley and Merced National Wildlife Refuges and the Gray Lodge Wildlife Area have used groundwater in supplementing some of their Level 2 supplies, and will continue to use groundwater. Reclamation is participating in additional studies and projects that may result in further increases in groundwater usage as part of long-term refuge water supplies. For example, Reclamation is funding a three year project to examine the utility of integrating groundwater into the Grasslands Level 4 water supply.

Improving quality of water supplies

In late 2007, Reclamation entered into an agreement for GWD to implement a water quality monitoring program on lands within the Grassland ecological area. GWD will be monitoring water quality on GWD, and DFG refuge lands and FWS lands. The data generated will be used to manage wetlands more efficiently and monitor the quality of water leaving the refuges.

The RWSP has developed a draft Refuge Water Quality Best Management Practices (BMP) Plan, with the Service as project lead. The BMP Plan is consistent with the requirement in the 2005 CALFED legislation to reduce water quality impacts of refuge discharges that receive federal water and discharge into the San

Joaquin River. The final report was issued in 2008 and its conclusions will be put into practice in future years. One of the proposed practices is additional water quality monitoring to track flows and discharges from refuges to the San Joaquin River.

Table 15. Refuge Water Type and Mandated Target

Water Type	Volume Required by the Act (Acre-Feet Per Year)
Level 2 water	396,244[a]
Incremental Level 4 water	159,271[a]
Full Level 4 water	555,515

[a] The totals of 396,244 ac-ft of Level 2 water and 159,271 ac-ft of Incremental Level 4 water from the "1989 Reports" differ from the totals of Level 2 and Incremental Level 4 water under the Water Supply Contracts by 26,007 ac-ft. Level 2 water under the Water Supply Contracts includes Replacement water of 26,007 ac-ft. Replacement water is water which Reclamation provides from Central Valley Project yield to certain CVPIA refuges through contracts with refuge managing agencies executed prior to the passage of CVPIA. Under the Water Supply Contract, the Incremental Level 4 amounts have been reduced by this same amount.

Table 16. Water Allocations by Refuge from 1989 Reports

Refuge Name - Region	Full Level 4 Water (Acre-Feet)	Level 2 Water (Acre-Feet)	Incremental Level 4 Water (Acre-Feet)
Grassland Water District (private) - San Joaquin Valley			
Grassland Resource Conservation District	180,000	125,000	55,000
CA Department of Fish and Game - Sacramento Valley			
Gray Lodge Wildlife Area	44,000	35,400	8,600
CA Department of Fish and Game - San Joaquin Valley			
Volta Wildlife Area	16,000	10,000	6,000
Los Banos Wildlife Area	25,000	16,670	8,330
Salt Slough Unit	10,020	6,680	3,340
China Island Unit	10,450	6,967	3,483
Mendota Wildlife Area	29,650	18,500	11,150
U.S. Fish and Wildlife Service - Sacramento Valley			
Sacramento National Wildlife Refuge	50,000	46,400	3,600
Delevan National Wildlife Refuge	30,000	20,950	9,050
Colusa National Wildlife Refuge	25,000	25,000	0
Sutter National Wildlife Refuge	30,000	23,500	6,500
U.S. Fish and Wildlife Service - San Joaquin Valley			
San Luis Unit	19,000	13,350	5,650
Kesterson Unit	10,000	3,500	6,500
West Bear Creek Unit	10,810	7,207	3,603
Freitas Unit	5,290	3,527	1,763
Merced National Wildlife Refuge	16,000	13,500	2,500
East Bear Creek Unit	13,295	8,863	4,432
U.S. Fish and Wildlife Service - Tulare Lake Basin			
Kern National Wildlife Refuge	25,000	9,950	15,050
Pixley National Wildlife Refuge	6,000	1,280	4,720
TOTAL	555,515	396,244[a]	159,271[a]

[a] The totals of 396,244 ac-ft of Level 2 water and 159,271 ac-ft of Incremental Level 4 water from the "1989 Reports" differ from the totals of Level 2 and Incremental Level 4 water under the Water Supply Contracts by 26,007 ac-ft. Level 2 water under the Water Supply Contracts includes Replacement water of 26,007 ac-ft. Replacement water is water which Reclamation provides from Central Valley Project yield to certain CVPIA refuges through contracts with refuge managing agencies executed prior to the passage of CVPIA. Under the Water Supply Contract, the Incremental Level 4 amounts have been reduced by this same amount.

Water Acquisition Program – Refuge Water

FY 2008

Funding Obligation

$6,782,000 (Restoration Fund)

Accomplishments

- Acquired 30,308 acre-feet of water for Incremental Level 4 deliveries

Ross's Geese, Merced National Wildlife Refuge

CVPIA Sections 3406(b)(3) and 3406(d)(2)

Per the Act, Full Level 4 water supplies were to be delivered to all CVPIA refuges on an annual basis by 2002. From 2002 to 2008, the Water Acquisition Program (WAP) acquired between 45,000 and 85,000 acre-feet each year of Incremental Level 4 water. These acquisitions relied primarily on transfers from the San Joaquin River Exchange Contractors, one-year transfers from other CVP contractors such as the Cross Valley Canal Contractors, and occasional groundwater purchases. The average of this volume represents approximately 40 percent of the mandated quantity (159,271 acre-feet).

Due to the dry hydrologic conditions in Water Year (WY) 2007, the WAP acquired only 41,111 acre-feet of Incremental Level 4 water. Specifically, the WAP was only able to purchase 30,000 acre-feet of water from the Exchange Contractors, and entered into a one-year acquisition with the Kern-Tulare/Rag Gulch Water Districts for 11,111 acre-feet for the year for a total of 41,111 acre-feet. The high cost of water acquisition and the lack of willing sellers made the WY 2007 market very difficult.

Measuring Success

The recent history of very dry conditions explains the program's inability to come anywhere near the target acquisition volume of 159,271 acre-feet of water, and when coupled with current lower storage conditions in the Central Valley Project, also presents the very real possibility that these shortfalls may continue into the future.

Water Year 2008 was much the same story. Critically dry conditions throughout the state meant a paucity of willing sellers, and consequently the WAP was able to purchase only 30,308 acre-feet for Incremental Level 4 purposes.

Approximately 24,132 acre-feet was obtained from the Exchange Contractors, as well as 3,222 acre-feet from Stevinson Water District and 2,954 acre-feet from a groundwater project operated by Grassland Water District. Table 17 shows the actual water deliveries for Level 2 and Incremental Level 4.

Table 17. Level 2 and Incremental Level 4 Water Deliveries by Water Year (2002-2008)

Water Year[a]	Level 2 - Actual Deliveries and Percent of Target 422,251[b] (Acre-Feet)	Incremental Level 4 – Actual Deliveries and Percent of Target 133,264[b] (Acre-Feet)
2002	383,842 (91%)	80,970 (61%)
2003	391,635 (93%)	77,053 (58%)
2004	385,731 (91%)	68,262 (51%)
2005	388,803 (92%)	83,211 (62%)
2006	380,072 (90%)	90,545 (68%)
2007	388,521 (92%)	45,049 (34%)
2008	386,181[c] (91%)	35,566[c] (27%)

[a] *Water Year* is defined as beginning on the first day of March through the last day of February of the following year.
[b] This table reflects deliveries starting with Water Year 2002, the beginning year that CVPIA mandated Full Level 4 deliveries for all refuges [Section 3406(d)(2)]. The target values used for total Level 2 and Incremental Level 4 water amounts (see column headers) are those identified from the Water Supply Contracts.
[c] Delivery amounts do not include Pixley or Merced.

Refuge Facilities Construction Program and San Joaquin Basin Action Plan Lands Program

FY 2008

Funding Obligation

$10,264,000 (Facilities Construction – Restoration Fund)

$941,000 (San Joaquin Basin Action Plan Lands – Restoration Fund)

$42,000 (San Joaquin Basin Action Plan Lands – Water & Related)

Accomplishments

- Completed the Final Conveyance of Refuge Water Supply South San Joaquin Valley Study Area Mendota Wildlife Area Environmental Assessment/Impact Statement
- Continued work to support completion of the draft Design Data Report on conveyance facilities of the Biggs-West Gridley Water District (BWGWD) for conveyance of Refuge water supplies to Gray Lodge WA
- Completed two HEC-RAS model alternatives for the conveyance facilities of the BWGWD
- Completed major construction and preliminary testing of the Phase I, East Bear Creek Pumping Plant and Pipeline at the San Luis NWR in Los Banos, CA

East Bear Creek Unit, Phase 1, Water Regulating Tank

CVPIA Section 3406(d)(5)

As of 2008, Reclamation has the physical ability to deliver Full Level 4 supplies to 14 of the 19 CVPIA refuges.

The Refuge Facilities Construction Program and the San Joaquin Basin Action Plan Construction Program identified 17 construction projects (with a total of 46 major structures/actions) required to provide Full Level 4 conveyance capacity to all CVPIA refuges. These infrastructure improvements can be divided into two categories:

- Modify existing facilities–Existing conveyance facilities can be upgraded to overcome capacity constraints
- Construct new facilities–New facilities are constructed where there is no existing system, or where modifications to an existing system would not be sufficient to meet demand

To date, these two programs have completed 31 of the 46 major structures/actions identified in the environmental documents and related design and specification documents. Table 18 lists all major structures/actions completed, with 1997 being the first year for completion.

Measuring Success

Refuge Facilities Construction Program – 2008 Accomplishments

Reclamation completed the Final Conveyance of Refuge Water Supply South San Joaquin Valley Study Area Mendota Wildlife Area Environmental Assessment/

Impact Statement (EA/IS) with an emphasis on potential actions to provide annual reliable Full Level 4 water supplies to the Mendota Wildlife Area (WA) as required by CVPIA. The Final Mendota WA EA/IS was released in May 2008 and is available on the Reclamation web site.

Table 18. Cumulative Completed Construction Actions by Year (1997-2008)

Fiscal Year	Number of Major Structures/ Actions (Completion Percent of 46 Major Structures/Actions Target)
1997	3 actions (7%)
1998	5 actions (11%)
1999	11 actions (24%)
2000	21actions (46%)
2001	22 actions (48%)
2002	23 actions (50%)
2003	24 actions (52%)
2004	28 actions (61%)
2005	30 actions (65%)
2006	30 actions (65%)
2007	31 actions (67%)
2008	31 actions (67%)

The program continued implementation on work to support completion of the draft Design Data Report on conveyance facilities of the Biggs West Gridley Water District (BWGWD) for conveyance of Refuge water supplies to Gray Lodge WA. This report analyzes several aspects of the proposed conveyance facility including canal water levels, flow through the facility, and seepage; the report also provides a list of system improvements and cost estimates. The program completed two HEC-RAS model alternatives for the conveyance facilities of the BWGWD. The alternatives study the extent of conveyance system improvements needed to satisfy the delivery of Full Level 4 water supplies to the Gray Lodge WA.

San Joaquin Basin Action Plan - 2008 Accomplishments

Work in FY 2008 consisted of the completion of major construction and preliminary testing of the Phase I, East Bear Creek Pumping Plant and Pipeline at the San Luis NWR in Los Banos, CA. Final testing and training exercises are expected to occur in the first quarter of FY 2009 and the project will be substantially complete the second quarter of FY 2009.

East Bear Creek Unit, Phase 1, Pumping Plant and Surge Tank

Refuge Water Conveyance (Wheeling)

FY 2008

Funding Obligation

$137,000 (Restoration Fund)

Accomplishments

- Delivered approximately 400,362 acre-feet of Level 2 water to the refuges; 41,111 acre-feet from diverse sources such as groundwater, water rights water, and mitigation water.
- Delivered approximately 37,066 acre-feet of Incremental Level 4 water.
- Finalized negotiations with Biggs West Gridley Water District and the California Department of Fish and Game resulting in a water accounting methodology for deliveries to the Gray Lodge WA
- Negotiated a fourth amendment to extend the groundwater pumping reimbursement agreement with DFG. Groundwater combined with limited surface water deliveries provides Full Level 2 allocation at Gray Lodge WA
- Continued the cost share development process to determine current cost share apportionment for the State of California related to Incremental Level 4 water supplies
- Continued management of a conservation easement of 113 acres of giant garter snake mitigation habitat

Colusa NWR, Giant Garter Snake Habitat Increased

CVPIA Sections 3406(d)(1), (2), and (5)

Reclamation delivered approximately 92 percent of the mandated Level 2 water on average, between Water Year (WY) 2002 and WY 2008. This includes water from sources other than CVP yield.

Numerous biological benefits have resulted from a reliable year-round water supply through CVPIA that adequately meets the delivery schedule for wetland management on CVPIA wildlife refuges. Habitat is now available during the months of August and early September that benefits early migrant waterfowl and shorebirds; habitat is also provided for resident wildlife and their young during a critical time of the year when wetland habitat can be particularly limited by hydrology. Applying water for semi-permanent and permanent wetland habitat in the spring and summer directly benefits the recovery of special status species such as the giant garter snake, white-faced ibis, and tricolored blackbirds. Wintering wildlife also benefit from this habitat diversity.

Seasonal wetlands are now maintained and de-watered to coincide with peak migration times of shorebirds and waterfowl. Timely de-watering also promotes the germination and irrigation of important moist-soil food plants, such as swamp timothy grass and watergrass. These plants provide a high-energy food source through both their seeds and associated invertebrate communities. The increase in supply reliability allows wetland managers to lower water depths to make seeds and invertebrates available without the fear of having wetlands completely evaporate.

Reliable water supply has significantly improved the battle against avian disease outbreaks, such as botulism and cholera by creating a "flow through" system of water delivery and drainage. This "flow through" reduces the stagnant conditions under which avian diseases thrive. It also helps deal with wetland areas high in salinity, which are often lower in productivity and diversity. CVPIA water allows wetland managers to "flush" salts from wetland basins and improve soil quality.

Measuring Success

In WY 2008, approximately 400,362 acre-feet of Level 2 water was delivered to the refuges. Of that number, 41,111 acre-feet were from diverse sources other than Project water, such as water rights water, groundwater and mitigation water from a Federal Energy Regulatory Commission (FERC) licensing agreement. In addition, approximately 37,066 acre-feet of Incremental Level 4 water was delivered to the refuges.

In Fiscal Year 2008, Reclamation finalized negotiations with Biggs West Gridley Water District (BWGWD) and DFG resulting in a water accounting methodology that provides for equitable accounting of DFG water rights water, Project water, and Reclamation acquired water delivered to the Gray Lodge WA through the BWGWD facilities. Reclamation also negotiated a fourth amendment to extend the groundwater pumping reimbursement agreement with DFG. Groundwater is combined with limited surface water deliveries to provide full Level 2 allocation at Gray Lodge WA until facilities improvements to BWGWD are complete.

Reclamation continued the cost share development process to determine current cost share apportionment for the State of California related to Incremental Level 4 water supplies, including water acquisition, certain conveyance facilities construction, and water delivery costs. This process is covering the last seven federal fiscal years, and efforts are coordinated with the Service, DFG, and DWR. The resulting task order will culminate with an invoice to DFG for their cost share.

Reclamation and the Service continued management of a conservation easement of 113 acres of giant garter snake habitat from May 1 through September 30, 2008, on a privately-owned site in Glenn County. This habitat was restored in 2002 and is maintained annually to satisfy the mitigation requirements made necessary by refuge conveyance construction activities in the Sacramento Valley.

Kern NWR, Tri-colored Blackbird Habitat and Nest Success Improved

Ecosystem and Water Systems Operations Models

FY 2008

Funding Obligation

$402,000 (Restoration Fund)

$735 (Water & Related)

Accomplishments

- Completed a QA/QC review of the Sacramento Valley hydrology –CalSim III
- Implemented a QA/QC review of the San Joaquin Valley – CalSim III
- Developed a GIS based interface to increase user accessibility – CalSim II
- Used modeling in support of the 2008 OCAP Biological Assessments - CalSim II, SALMOD and various temperature models
- Continued testing the model and added climate change impacts and sea level rise capability – CalLite
- Applied the upper Sacramento River Water Quality model (USRWQM) and the San Joaquin temperature model that provide simulations of water temperature
- Continued the development and application of ecosystem models to evaluate the effects of reservoir operations and river flows on anadromous fish and riparian habitats on the Sacramento River - CalSim, USRWQM and RHEM
- Continued the development of surface and sub-surface watershed and operations model linkage – HGS and CalSim

CVPIA Section 3406(g)

"The Secretary, in cooperation with the State of California and other relevant interests and experts, shall develop readily usable and broadly available models and supporting data to evaluate the ecologic and hydrologic effects of existing and alternative operations of public and private water facilities and systems in the Sacramento, San Joaquin, and Trinity River watersheds."

The goal of the Ecosystem and Water Systems Operations Models Program (EWSOMP) is to develop broadly available and readily accessible models and supporting data to evaluate existing and alternative water management strategies. By demonstrating the effect of water operations on quality and quantity of various habitats, these models improve the scientific understanding of ecosystems in the Sacramento, San Joaquin and Trinity watersheds.

As part of the model development process, the program continues to support hydrologic and biologic data collection. Measures to determine the effectiveness of the models and timeframes for this program have not yet been determined.

The program is an essential tool for Interior. Since 1998 EWSOMP has provided a high level of support for the development of the integrated CVP/SWP model, CalSim II. The primary benefit of CalSim II has been for planning investigations, including the 2008 CVP OCAP. CalSim II has been used in many other studies, including the ongoing CALFED storage and conveyance investigations. CalSim II is available for public review and use. A new version of the model, CalSim III and a

water management screening tool, CalLite, are currently being developed jointly by Reclamation and DWR. The CalSim III model, scheduled for release in summer 2009, will have substantially improved spatial resolution, hydrology and groundwater simulation capabilities.

In addition to CalSim, the program supports the development and application of other types of river management and ecological models including water quality, hydrology, groundwater, fish population and riparian habitat models used for support of operations and planning by Reclamation's Division of Planning, the Service, federal and state water contractors and public interest organizations.

This program also supports participation of Reclamation and Service staff in professional organizations as well as CalSim training conducted by Reclamation and the DWR.

Measuring Success

EWSOMP continues to perform data collection activities to support modeling and improvement of scientific understanding of ecosystems in the Sacramento, San Joaquin and Trinity watersheds. To date, the program is operating the integrated CVP/SWP model (CalSim II) and seven other models; two additional models are currently under development (Table 19).

The program goal is to complete at least nine models. Currently, the Upper Sacramento River Water Quality Model (USRWQM) is complete; six models are complete, but are being updated (CalSim II, RHEM, LAWS, ECOSIM, InSalmo, and SALMOD); and four models are not complete (CalSim III, San Joaquin Basin Temperature Model, HydroGeoSphere, and CalLite).

Of the models listed in Table 19, the following are currently under development or undergoing significant modifications:

Water Operations Tools – CalSim II/III Model

The major accomplishments for the CalSim II model in FY 2008 included: a GIS based interface was developed that allowed the CalSim II model to be more readily accessible to users and the 2008 OCAP Biological Assessments modeling relied heavily on CalSim II, the salmon habitat suitability model (SALMOD) and various temperature models.

New hydrologic datasets for CalSim III in the Sacramento and San Joaquin valleys were developed in 2007. Additionally, the program completed significant improvements for the CalSim III model including enhanced methods for evaluating hydrologic inputs, groundwater simulation capabilities, and more consistent implementation of hydrology and groundwater in both the Sacramento and San Joaquin Valleys. In FY 2008, Reclamation, DWR and Service modelers continued the development and applications of water operations and water management tools. These activities included participation in a multi-agency effort to review and improve the CalSim III model for the Sacramento and San Joaquin Valleys. FY 2008 CalSim III activities also included completion of a quality assurance/quality control (QA/QC) review of the Sacramento Valley hydrology to improve the simulation of agricultural, environmental and municipal water supplies and demands and implementation of a QA/QC review of the San Joaquin Valley.

Water Management Tool – CalLite Model

The CalLite model is under development and can simulate water conditions in the Central Valley over an 82-year planning period in under five minutes and can be used to modify a variety of interactive water management actions including new conveyance facilities, off-stream storage reservoirs, groundwater management programs, and river and Delta channel flow and salinity targets. In addition, it can be used to simulate observed or possible future hydrologic regimes to represent climate change impacts and sea level rise. This tool will provide more rapid and interactive policy evaluation. In FY 2008, Reclamation and DWR continued testing the model, in addition to the base model; the climate change impacts and sea level rise capability were added to the model. The base model is planned for public release in spring 2009.

Ecosystem Modeling Tools Development

The program continued developing and applying ecosystem models to evaluate the effects of reservoir operations and river flows on anadromous fish and riparian habitats on the Sacramento River. These activities included the use of several existing models including CalSim, Upper Sacramento River Water Quality Model (USRWQM), and Riparian Habitat Establishment Model (RHEM).

Table 19. Ecosystem and Water Systems Operations Models (1996-2008)

Model	Initiation/ Operational Date	Agencies Involved in Development	Description
CalSim II	1998/2002	Reclamation, DWR, Service, federal/state water contractors, Sacramento Valley Settlement contractors	Used for coordinated system-wide planning and operations of CVP and SWP water projects
CalSim III	2007	Reclamation, DWR, Service, federal/state water contractors, Sacramento Valley Settlement contractors and San Joaquin Valley Exchange Contractors	Used for coordinated system-wide planning and operations of CVP and SWP water projects
CalLite	2007	Reclamation, DWR and state water contractors	Used for coordinated system-wide operations and water management decision projects
Upper Sacramento River Water Quality Model (USRWQM)	2001/2003	Reclamation, Service, NOAA, NMFS and CALFED Integrated Storage Investigation (ISI)	Used for planning and operations of reservoirs for water temperature management in anadromous fish spawning and rearing habitats
San Joaquin Basin Temperature Model	2005/2007	Consultants and Reclamation	Used to simulate flow and water temperature relations correlating to reservoir operations
Riparian Habitat Establishment Model (RHEM)	2007	Reclamation, CALFED ISI	Used for planning and operations of reservoirs for the recruitment and survival of cottonwood and other riparian vegetation
InSalmo	1996/2005 Beta version; awaiting calibration and validation	Consultants under contract to the Service	Used in planning studies to evaluate effects of reservoir operations on anadromous fish spawning, incubation and rearing
SALMOD	1996/2005	USGS and Reclamation consultants	Used in planning studies to evaluate effects of reservoir operations on anadromous fish spawning, incubation and rearing habitats
Land Atmosphere Water Simulation (LAWS)	2002/2006	Reclamation	Used to develop hydrologic budgets and water demands for CalSim model
HydroGeoSphere (HGS)	2003/2005	Reclamation	Used for planning of surface and subsurface hydrologic interactions related to water supply, water quality and ecosystem restoration
Ecologically Cogent Operations Suite of Integrated Models (ECOSIM)	1998/1998	Service	Used for analyses of changes to the macroscopic water resources including CVP/SWP operations

In FY 2008, results from the USRWQM water model were used as inputs to SALMOD to evaluate the effects of alternatives for the Shasta Enlargement and North of Delta Off-stream Storage EIS/R, feasibility investigations, and OCAP biological assessments. These models have been used to evaluate the benefits and impacts of alternate water management strategies for the Sacramento River.

Reclamation staff completed initial model development and field data collection studies for the RHEM in 2007. In 2008, a controlled field study of cottonwood seedling growth was performed to develop parameters for the RHEM; additional development of a two-dimensional version of the RHEM is under way.

The Ecologically Cogent Operations Suite of Integrated Models (ECOSIM) had some minor improvements in 2008, including completing modifications to the water module code to dynamically simulate the Yuba River sub-system. More major improvements are planned for FY 2009.

HydroGeoSphere (HGS) – Thermal/ Temperature Transport Module Development

The HGS model was modified to link the model to CalSim and to incorporate a temperature module.

The linkage of the HGS and CalSim includes four major tasks. These tasks include: 1) conduct literature review; 2) modify code; 3) verify and validate the linkage and 4) prepare historical and future meteorological data for input into the linked model. Most of the sub-tasks under Task 1 for literature review were completed in 2008, with the exception of the linkage approach and finalization of the Task 1 report.

The major tasks for temperature module incorporation are: 1) apply field data and information into the model; and 2) test and verify the module with San Joaquin Valley field conditions. In 2008, with the assistance of the consultants (University of Waterloo), a temperature module was incorporated, verified, and validated.

Water Quality Modeling Tools – Water Quality and Temperature Models

The water quality modeling activities in 2008 included the application of the USRWQM and the San Joaquin Basin temperature model that provide simulations of water temperature for planning, operations, and river restoration projects of the Sacramento and San Joaquin Basin. The San Joaquin temperature model is used to evaluate flow and temperature relation for the San Joaquin River Restoration Program.

Land Retirement Program

FY 2008

Funding Obligation

$630,000 (Restoration Fund)

Accomplishments

- Retired 320 acres from agricultural production
- Restored 320 acres to upland habitat by planting three native seed mixes and installed artificial kit fox burrows at the Atwell Island Land Retirement Demonstration Proeject site
- Eliminated the production of 3,500 acre feet of poor quality agricultural drainage
- Produced over 1,000 pounds of native seed for site restoration at the San Joaquin Valley Native Plant Nursery

Restored Native Flora at the Atwell Island LRDP Site

CVPIA Section 3408(h)

"The Secretary is authorized to purchase from willing sellers land and associated water rights and other property interests…which receives Central Valley Project water under a contract executed with the United States, and to target such purchases to areas deemed most beneficial to the overall purchase program, including the purposes of this title."

The Land Retirement Program (LRP) purchases land, water and other property interests from willing sellers who receive CVP water. By ceasing irrigation of these agricultural lands, the program reduces the volume of agricultural drainage produced, and provides the opportunity to protect and restore the retired land for wildlife habitat.

The San Joaquin Valley Drainage Program (SJVDP) recommended retiring 75,000 acres of drainage impaired farmland from irrigated agricultural production by 2040 (SJVDP, 1990). The LRP has three targets that support this long-term goal:

- Retire 15,000 acres of agricultural land by 2014 for the Land Retirement Demonstration Project (LRDP)
- Restore appropriate habitat on 400 acres of retired lands per year on LRDP sites
- Reduce the production of agricultural drainage water annually by 6,000 acre-feet upon completion of the LRDP

The LRDP was implemented in 1999 at two sites in the western San Joaquin Valley (Tranquillity, managed by Reclamation) and the Tulare Lake Basin (Atwell

Island, managed by BLM) to study the environmental impacts of land retirement and to evaluate cost-effective restoration strategies for retired lands (Figure 30).

Figure 30. Land Retirement Program Sites

Measuring Success

Retiring and Restoring Lands

Of the targeted 15,000 acres, to date Interior has acquired approximately 9,300 acres and retired (removed from irrigated agriculture) approximately 8,900 acres from agricultural production. In 2008, the program restored 320 acres of retired land to upland wildlife habitat (Table 20).

On average, the LRP has exceeded its land restoration performance goal of 400 acres per year. Since 1998, the LRP has restored approximately 5,300 acres. Complete restoration to upland habitats found in the San Joaquin Valley will take many years to achieve, but the program has developed cost effective restoration techniques and continues to adapt these techniques to achieve desired habitat values.

Restoration efforts on retired lands immediately increased biodiversity and abundance, including Special Status Species. Wildlife surveys of restored units observed important findings of sensitive San Joaquin Valley wildlife species, including populations of endangered Tipton kangaroo rats, burrowing owls, coast horned lizards, San Joaquin Valley coachwhips, Swainson's hawks and a sensitive plant called Hoover's woolystar. The Atwell Island wildlife sightings database now contains more than 18,000 observations. Using the database, BLM developed plant and animal lists and a photo-illustrated flora for the Atwell Island Project Area.

In 2008, BLM planted 320 acres with three native seed mixes at the Atwell Island LRDP site. Artificial kit fox burrows were also installed on ecological restoration sites at the Atwell Island LRDP site.

At Tranquillity, the San Joaquin Valley Native Plant Nursery produced more than 1,000 pounds of native seed propagated from more than 100 plants species collected within a 50-mile radius of the site.

Reducing Agricultural Drainage

Implementating the LRDP has eliminated the production of approximately 3,500 acre feet of poor quality drain water annually, including in 2008. Five years of groundwater monitoring at the LRDP sites show a declining shallow water table in response to land retirement. The water table responses observed at the LRDP sites are representative of conditions present at a high percentage of lands that are targeted for retirement in the western San Joaquin Valley and the Tulare Lake Basin. The declining shallow water table observed beneath demonstration project lands indicates the success of land retirement as a drainage reduction strategy.

The declining shallow water table is an important aspect of land retirement because the groundwater beneath the LRDP lands is generally of poor quality with high concentrations of salt and trace elements such as selenium. As long as the water table continues to decline as expected in response to land retirement, the selenium in the groundwater should have no consequences to biota at the site. Decreasing selenium and salinity trends in the surface soil indicate that upward flux of salt and selenium from capillary rise and evaporation of shallow groundwater at the soil surface is minimal, and that some downward leaching of soluble selenium and salt from surface soils occurred during the five-year LRDP study. Selenium concentrations in biota have not changed significantly over the study period and are below concentrations of concern to the U.S. Environmental Protection Agency (EPA) and the Service.

Table 20. Land Acquired, Retired & Restored by Year at Tranquillity and Atwell Island Sites (1992-2008)

	Acres Acquired (Annual)		Acres Retired from Agriculture (Annual)	Acres Restored (Annual)
Year	Atwell Island	Tranquillity	Atwell Island and Tranquillity	Atwell Island and Tranquillity
1992	0	0	0	0
1993	0[a]	0	0	0
1994	0	0	0	0
1995	0	591	591	0
1996	0	0	0	0
1997	0	0	0	0
1998	0	995	994	1,220
1999	0	60	61	100
2000	2,645[b]	0	2,645	777
2001	1,414	444	686	702
2002	1,510	0	1,698	373
2003	616	0	250	261
2004	155	0	570	308
2005	625	0	850	349
2006	38	0	38	416
2007	213	0	213	475
2008	0	0	320	320
TOTAL	**7,216**	**2,090**	**8,916**	**5,301**

[a] Prospect Island (1228 acres) was purchased in 1995 in Sacramento before the Demonstration Project was initiated and is not considered part of or counted toward the Land Retirement Demonstration Project acquisition total.

[b] 455 acres of this purchase in AIWD was paid for by CVP Conservation Program.

APPENDIX A: GLOSSARY OF TERMS

Acre-foot (AF): The quantity of water required to cover one acre to a depth of one foot. Equal to 1,233.5 cubic meters (43,560 cubic feet)

Anadromous fish: Stocks of salmon, steelhead, striped bass, white and green sturgeon, and American shad that ascend the Sacramento and San Joaquin rivers and their tributaries and the Sacramento-San Joaquin Delta to reproduce after reaching maturity in the San Francisco Bay or the Pacific Ocean; fish species that spend most of their lives in the ocean but reproduce in fresh water

Anadromous Fish Restoration Program (AFRP): A program authorized by the CVPIA to address anadromous fish resource issues in Central Valley streams that are tributary to the Delta

Biota: Total collection of organisms of a geographic region or a time period

CALFED Bay-Delta Program: A unique collaboration among 25 state and federal agencies that came together to improve California's water supply and the ecological health of the San Francisco Bay/Sacramento-San Joaquin River Delta

Capillary rise: Movement of water upwards from the water table (the top of the groundwater) into the unsaturated soil above; can be likened to a dry sponge (the unsaturated soil) being placed on top of a wet surface (the water table), the sponge sucking up water being similar to capillary rise in soils

Central Valley: Area in the central portion of California bounded by the Cascade Range to the north, the Sierra Nevada to the east, the Tehachapi Mountains to the south and the coast ranges and San Francisco Bay to the west

Central Valley Project (CVP): As defined by Section 3403(d) of the CVPIA, "all Federal reclamation projects located within or diverting water from or to the watershed of the Sacramento and San Joaquin rivers and their tributaries as authorized by the Act of August 26, 1937 (50 Stat. 850) and all Acts amendatory or supplemental thereto, ..."

Central Valley Project water: As defined by Section 3403(f) of the CVPIA, "all water that is developed, diverted, stored, or delivered by the Secretary in accordance with the statutes authorizing the Central Valley Project in accordance with the terms and conditions of water rights acquired pursuant to California law."

Central Valley Project Improvement Act (CVPIA): Public Law 102-575, Title 34. This law was passed in 1992 for the following purposes:

a) Protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California

b) Address impacts of the Central Valley Project on fish, wildlife and associated habitats

c) Improve the operational flexibility of the Central Valley Project

d) Increase water-related benefits provided by the Central Valley Project to the State of California through expanded use of voluntary water transfers and improved water conservation

e) Contribute to the State of California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary

f) Achieve a reasonable balance among competing demands for use of Central Valley Project water, including the requirements of fish and wildlife, agricultural, municipal and industrial and power contractors

Central Valley Habitat Joint Venture (CVHJV): The association of federal and state agencies

and private parties established for the purpose of developing and implementing the North American Waterfowl Management Plan as it pertains to the Central Valley of California

Constant Fractional Marking Program (CFM): When fish are counted for CVPIA monitoring, program managers differentiate between wild and hatchery fish; hatcheries mark a percentage of juveniles before they are released and when fish come back to spawn, the mark will indicate which were hatchery-born

Diversion: Area where river water is rerouted in a direction other than its natural course

Entrainment: When fish are diverted from their natural spawning course (e.g., caught in a water pump or diverted from the river into a canal)

Environmental Impact Statement (EIS): An analysis required by the National Environmental Policy Act (NEPA) for all major federal actions, which evaluates the environmental risks of alternative actions

Escapement: Measurement of adult spawning anadromous fish (e.g., salmon) that manage to return to their spawning stream

Firm water supplies: Non-interruptible water supplies guaranteed by the supplier to be available at all times except for reasons of uncontrollable forces or continuity of service provisions

Flow: The volume of water passing a given point per unit of time, usually measured in cubic feet per second (cfs)

Habitat: Area where a plant or animal lives

Level 2: A term used to refer to refuge water supply deliveries; the 1989 and 1992 Refuge Water Supply Studies define Level 2 refuge water supplies as the average amount of water the refuges received between 1974 and 1983

Level 4: A term used to refer to refuge water supply deliveries; Level 4 refuge water supplies are defined in the 1989 and 1992 Refuge Water Supply Studies as the amount of water for full development of the refuges based upon management goals developed in the 1980s

Measure: A type of program activity defined by CVPIA provisions that includes specific physical or structural actions

Metric: The defined quantifiable measurement of outputs or outcomes

Mitigation: One or all of the following: (1) Avoiding an impact by not taking a certain action or parts of an action; (2) minimizing impacts by limiting the degree or magnitude of an action and its implementation; (3) rectifying an impact by repairing, rehabilitating, or restoring the affected environment; (4) reducing or eliminating an impact over time by preservation and maintenance operations during the life of an action; and (5) compensating for an impact by replacing or providing substitute resources or environments

Natural Production: As defined by Section 3403(H) of the CVPIA, “fish produced to adulthood without direct human intervention in the spawning, rearing, or migration processes”

Outcome: The intended results or consequences to be achieved through implementing measures and programs described in the CVPIA

Output: The specific actions, measures, programs and services produced by Reclamation and the Service and provided to the public or others; outputs are the activities of the CVPIA Program to achieve the outcomes defined by the Act or developed by Reclamation and the Service to achieve the environmental restoration purposes

Pelagic Organism Decline: A recent decline in both abundance and species richness of pelagic (living in water above the bottom) organisms within the Sacramento-San Joaquin Delta; pelagic organisms include, most notably, the delta smelt and longfin smelt, federally-listed endangered species of fish

Program: The overall effort to implement the provisions of CVPIA

Program Activity: The individual provisions of CVPIA that are being implemented by “program managers” at Reclamation and the Service

Program Manager: The staff at Reclamation and the Service that oversees implementation of the CVPIA program activities; each active program activity has a program manager from its respective agency

Redd Dewatering: Occurs when redds (fish egg “nests”) are left exposed by receding water levels

Restoration Fund: The fund established by Section 3407 of the CVPIA to contribute resources for the environmental restoration provisions of the Act; revenue comes into the fund primarily through surcharges on water and power contract rates

Restoration Fund Roundtable: A collective of stakeholders representing environmental organizations, federal and state resource agencies, water and power contractors, and other interested parties who meet as needed to discuss issues, news and activities related to the CVPIA and provide information to Reclamation and the Service

Riparian: Of or relating to or located on the banks of a river or stream

South Delta: Sacramento-San Joaquin Delta

Stranding: A term used to describe fish that are trapped in pools of water that have no connectivity to the larger stream because of insufficient flow

Target: The quantifiable or otherwise measurable characteristics that tell how well a program must accomplish a performance measure

Taxa: Designating an organism or group of organisms

Timeframe: The period of time when program activities occur (e.g. annual or long-term) that combine with a performance measure and target, establish a performance goal

Water Acquisition: The purchase of water from willing sellers

Weir: Type of fish ladder that utilizes a series of small dams and pools to create a long channel and allow spawning fish to get around an obstruction, like a dam

APPENDIX B: ACRONYMS

AF	acre-feet
AFRP	Anadromous Fish Restoration Program
AFSP	Anadromous Fish Screen Program
BA	Biological Assessment
BLM	Bureau of Land Management
BMP	Best Management Practices
BO	Biological Opinion
BWGWD	Biggs West Gridley Water District
CAMP	Comprehensive Assessment and Monitoring Program
CCWD	Contra Costa Water District
CFS	Cubic Feet per Second
CNDDB	California Natural Diversity Database
CPAR	CVPIA Program Activity Review
CVO	Central Valley Operations Office
CVP	Central Valley Project
CVPIA (Act)	Central Valley Project Improvement Act
DFG	California Department of Fish and Game
DMC	Delta Mendota Canal
DOI (Interior)	Department of the Interior
DWR	California Department of Water Resources
EA	Environmental Assessment
EBMUD	East Bay Municipal Utility District
ECOSIM	Ecologically Cogent Operations Suite of Integrated Models
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	US Environmental Protection Agency
ERP	Ecosystem Restoration Program
ESA	Endangered Species Act
EWA	Environmental Water Account
EWSOMP	Ecosystems and Water Systems Operations Models Program
FERC	Federal Energy Regulatory Commission
FMP	Fisheries Management Plan
FWS (Service)	US Fish and Wildlife Service
FY	Fiscal Year
GCID	Glenn-Colusa Irrigation District
GIS	Geographic Information System
GPM	Gallons per Minute
GPS	Global Positioning System
GWD	Grassland Water District

HRP	Habitat Restoration Program
ID	Irrigation District
IEP	Interagency Ecological Program
IFIM	Instream Flow Incremental Methodology
ISI	Integrated Storage Investigation
JPP	Jones Pumping Plant
LAWS	Land Atmosphere Water Simulation
LRDP	Land Retirement Demonstration Project
LRP	Land Retirement Program
LTP	Long-term Plan
LTRC	Long-Term Renewal Contracts
NEPA	National Environmental Policy Act
NFH	National Fish Hatchery
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Parks Service
NRCS	Natural Resource Conservation Service
NWR	National Wildlife Refuge
OCAP	Operations Criteria and Plan
OMB	Office of Management and Budget
PART	Program Assessment Rating Tool
PEIS	Programmatic Environmental Impact Statement
PEIS/R	Programmatic Environmental Impact Statement/Report
PG&E	Pacific Gas & Electric
POD	Pelagic Organism Decline
QA	Quality Assurance
QC	Quality Control
RBDD	Red Bluff Diversion Dam
RBRPP	Red Bluff Research Pumping Plant
RD	Reclamation District
RHEM	Riparian Habitat Establishment Model
ROD	Record of Decision
ROI	Return on Investment
RWSP	Refuge Water Supply Program
SDFF	South Delta Fish Facility Forum
SDIP	South Delta Improvement Program
SDP	Station Development Plan
SHIRA	Spawning Habitat Integrated Rehabilitation Approach
SJRA	San Joaquin River Agreement
SJRGA	San Joaquin River Group Authority
SJRRP	San Joaquin River Restoration Program
SJVDP	San Joaquin Valley Drainage Program
SNWR	Sacramento National Wildlife Refuge
SRSC	Sacramento River Settlement Contracts
SWP	State Water Project
TAF	Thousand acre-feet
TFCF	Tracy Fish Collection Facility
TFFIP	Tracy Fish Facility Improvement Program
TRRP	Trinity River Restoration Program
UC	University of California

USCOE	US Army Corp of Engineers
USGS	US Geological Survey
USRWQM	Upper Sacramento River Water Quality Model
VAMP	Vernalis Adaptive Management Plan
WA	Wildlife Area
WAP	Water Acquisition Program
WQCP	Water Quality Control Plan
WY	Water Year
YOY	Young-of-the-Year