

4. HABITATS

4.1. Tidal Perennial Aquatic Habitat

Introduction

Tidal perennial aquatic habitat consists of the estuary's edge waters, mudflats and other transitional areas between open-water habitats and wetlands. Similar habitats are defined by the San Francisco Bay Area Wetlands Ecosystem Goals Project (1999) as elements of tidal baylands which include mudflats, sandflats, and shellflats. Tidal perennial aquatic habitat is important for many fish, wildlife, and plants. It also supports many biological functions important to the Bay-Delta system. Many animal and plant species, identified as threatened or endangered under the California and federal Endangered Species Acts (ESAs), rely on tidal perennial aquatic habitat during some portion of their life cycle. These shallow waters are also associated with natural wetland and riparian habitats that are important to fish and wildlife of the Bay-Delta.

Applicable ERP Vision

The vision is to increase the area and improve the quality of connecting waters associated with tidal emergent wetlands and their supporting ecosystem processes to assist in the recovery of special-status fish and plant populations and provide high-quality aquatic habitat for other fish, wildlife, and plant communities dependent on the Bay-Delta.

Stage 1 Expectations

Stage 1 expectations were to develop a classification system for Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay habitats that can be used as a basis for conservation actions. Specific, numeric objectives were to be formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. Conservation and restoration activities would be prioritized within and among habitat types. Work would begin on those projects given highest priority within a year of adoption of the strategic plan.

Changes Attributable to ERP

Liberty Island Acquisition (ERP-97-B03 and ERP-00-F06) acquired 5,209 acres. Various habitats, including tidal perennial aquatic habitat, have been passively restored on Liberty Island since the acquisition. Although the acreage restored on Liberty Island

has not been formally documented, it is likely that it far exceeds the 1,000 acres called for in Stage 1. Liberty Island more than likely meets the North Delta Ecological Management Unit target to restore 1,500 acres of shallow-water habitat (tidal perennial aquatic habitat).

In the Central and West EMU of the Sacramento-San Joaquin Delta EMZ, a permanent conservation easement was placed on 140 acres of shallow water tidal perennial aquatic habitat on the *Fern-Headreach Tidal Perennial Aquatic and Shaded River Aquatic Conservation Project (ERP-98-F16)* in the Delta.

In the *Suisun Marsh Property Acquisition and Habitat Restoration (ERP-01-C04)* project, 67 acres of diked baylands were restored to tidal exchange. How much of that is tidal perennial aquatic has yet to be documented. At Shell Marsh along the Contra Costa shore of Southern Suisun Bay, another project is restoring a 200 acre parcel to various habitat types, including tidal perennial aquatic.

The project titled *Biological Restoration and Monitoring in the Suisun Marsh/North San Francisco Bay Ecological Zone (ERP-98-F22)* also monitored the restoration enhancement effects for 2 years after implementation. Early monitoring data documented that increases in abundance of wildlife occurred in the restored and replanted sections of the marsh. Increased productivity also provided benefits to native fish.

As noted above, not all projects tracked the amount of tidal perennial aquatic habitat created or restored, nor did ERP track work done by other organizations in concert with the implementing agencies. Conservation entities, including the Sonoma Land Trust, are actively implementing acquisition, preservation and restoration strategies in the Suisun Marsh EMU.

Project Summary Table

Table 1. Tidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-F06	Liberty Island Acquisition Acquired fee title interest in the remaining two privately-owned properties on Liberty Island, estimated at 449 acres; and to conduct restoration of tidal shallow water habitat, tidal emergent wetlands, and seasonal wetlands for aquatic and terrestrial species.	9/30/2007	\$2,625,153	Complete.

Table 1. Tidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-F07	McCormack-Williamson Tract Restoration Planning, Design and Monitoring Performed baseline studies necessary for project planning and design, and developed a long-term monitoring program for the 1,600 acre McCormack-Williamson Tract Delta island.	12/31/2007	\$355,000	Completed restoration planning and baseline studies for 1,512 acres of agricultural land.
ERP-00-F10	Determining the Biological, Physical and Chemical Characteristics of Ballast Water Arriving in San Francisco Bay Analyzed the data on ballast biota arriving in the San Francisco Bay Estuary to assess the risk of exotic introductions, determine treatment standards, and provide baseline data to assess management or treatment efforts and conduct critical comparative analyses between estuaries.	3/31/2007	\$583,739	Complete.
ERP-01-C01	Invasive Spartina Project This project was an expanded effort to plan and implement control measures for <i>Spartina alterniflora</i> , contributed to the overall scientific understanding of the species, and built a bay-wide infrastructure to detect and prevent its future invasions.	10/31/2006	\$1,793,661	Complete. Mapped ecological risks and priority control sites and distribution of invasive <i>Spartina</i> species throughout the Bay.
ERP-01-C04	Suisun Marsh Property Acquisition & Habitat Restoration Acquired property in the Suisun Marsh, along Hill Slough, currently managed as seasonal wetland and restore the area to a fully functioning self-sustaining tidal wetland ecosystem which includes low-marsh, high-marsh, and upland transition zones, increasing the area and contiguity of saline emergent wetlands thereby assisting in the recovery of at-risk species.	6/30/2006	\$536,750	Complete. Acquired Blacklock parcel (69 acres) and restored full tidal action and natural hydrology.
ERP-01-C05	Feasibility Study of the Ecosystem and Water Quality Benefits Associated with the Restoration of Franks Tract, Big Break, and Lower Sherman Lake Feasibility study which evaluated the potential to create ecosystem, water quality/supply, recreational, and other benefits at Lower Sherman Lake, Big Break, and Franks Tract, by modifying remnant levees to inhibit salt trapping and restoring tidal marsh habitat.	6/30/2005	\$1,218,105	Complete.
ERP-01-C09	Hill Slough West Habitat Restoration Demonstration Project, Phase II Completed the environmental documentation and permitting for a multi-phased project to restore tidal action to seasonal and permanent wetlands in the Suisun Marsh.	11/30/2006	\$87,000	Complete.

Table 1. Tidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-N13	<p>Phase II: Demonstration Project for the Protection and Enhancement of Delta In-Channel Islands (Construction & Monitoring)</p> <p>Pilot project which demonstrated biotechnical methods which can be used in lieu of riprap or other hard surfaces to protect valuable tidal wetlands associated with in-channel islands in the Delta.</p>	9/30/2006	\$1,145,400	Complete. Installed various biotechnical methods to control erosion and attenuate wave energy adjacent to 3 eroding ICI'S (in-channel islands) in the Delta. 2,159 linear feet of shoreline was treated, protecting a total of 6.24 acres of ICI habitat.
ERP-01-N19	<p>Ecological Monitoring of Tolay & Cullinan Ranch Tidal Wetlands Restoration</p> <p>Monitored the Tolay Creek (ERP-97-N19) and Cullinan Ranch (ERP-97-N18) Tidal Wetland Restoration Projects in the North San Francisco Bay.</p>	6/30/2006	\$593,931	Complete. Documented physical and biological changes in order to contribute to an understanding of the processes behind Tidal Wetland Restoration, and facilitate an adaptive management strategy.
ERP-02-C07-D	<p>Dutch Slough Tidal Marsh Restoration Project (Phase I)</p> <p>Acquired the three contiguous parcels totaling 1,166 acres that comprise the Dutch Slough site</p>	12/31/2006	\$23,550,000	Complete. Estimated restoration of up to 381 acres of shallow water (Tidal perennial aquatic habitat).
ERP-02D-P54	<p>Restoring Ecosystem Integrity in the Northwest Delta: Phase II</p> <p>This project proposes to acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, north Delta tidal channels located west of the Yolo Bypass.</p>	8/31/2008	\$1,781,658	Ongoing acquisition of conservation easements on 1,100 acres of existing riparian, wetland and/or agricultural lands. Currently in the process of acquiring an agricultural easement on 292 acres.
ERP-02D-P68	<p>Arundo Eradication and Coordination, Phase II</p> <p>Phase II of the <i>Arundo donax</i> eradication and coordination project. Funding for ongoing monitoring and followup treatments for 5 Phase I projects, and adds 5 new partners. Aims to remove approximately 273 acres of Arundo on over 63 miles of rivers and creeks.</p>	3/15/2009	\$2,033,859	Ongoing eradication on 5 new sites: Gray Lodge Wildlife Area, Lindo Creek, Lower American River, San Joaquin River, and Upper Cache Creek.
ERP-02D-P71	<p>Napa-Sonoma Marsh Restoration Project - Construction Phase (Ponds 3,4, and 5)</p> <p>Phase I of the Napa-Sonoma Marsh restoration project, a Federal USACE project which entailed the restoration of three former commercial salt ponds along the Napa River, totaling approximately 3,000 acres.</p>	6/30/2007	\$3,203,000	Complete. Restored Pond 3 (1,300 ac) to tidal marsh and associated marsh habitat. Breached levees on ponds 4 and 5 (combined 1,700 ac) for salinity reduction in preparation for restoration.

Table 1. Tidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P03-D	Dutch Slough Restoration Project Developed a restoration plan for a 1,166 acre site adjacent to Dutch Slough and the mouth of Marsh Creek in the western Delta.	11/2/2008	\$1,500,000	Ongoing.
ERP-02-P04-D	Napa-Sonoma Marsh Restoration Project Restoration of three former commercial salt ponds along the Napa River, totaling approximately 3,000 acres, to tidal marsh. It is a phase of the Napa-Sonoma Marsh restoration project, a Federal USACE project. Phase I will provide for restoration of Pond 3 (1,300 acres) to tidal habitats, and salinity reduction in preparation for tidal habitat restoration in Ponds 4 and 5 (1,700 acres).	11/7/2006	\$1,339,000	This project would have had some restoration measures, but according to the last two quarterly reports, task 5 (Construction) has been deleted from the project by amendment # 1 to ERP-02-P04D (S-02-RA-017) and handed over to the Wildlife Conservation Board.
ERP-02-P12	Sustainable Restoration Technologies for Bay/Delta Tidal Marsh and Riparian Habitat Protection of natural embankment and reconstruction through passive recruitment of new sediment to create new riparian and shaded riverine aquatic habitat in aquatic channels.	12/30/2006	\$1,800,000	Completed 3.72 river miles (1.99 miles in East Delta, 0.5 miles in North Delta, 0.81 miles in Central and West Delta, 0.42 miles in the Suisun Marsh and Bay) of restored riverbank, levee and shoreline tidal environments to riparian and marsh habitats.
ERP-02-P22	Shallow Open Water Habitats: Hydrodynamics and Benthic Grazing Developed, via field observation and modeling, a detailed view of how tides and wind-generated waves determine the physical structure and hydrodynamics of shallow estuarine waters, and how these physical processes can act to constrain net primary production through their effects on grazing and light. Field experiments will be carried out in the shallows of Grizzly Bay and in Franks Tract.	5/31/2007	\$616,605	Complete.
ERP-02-P25	McCormack-Williamson Tract Restoration: Wildlife-Friendly Levee Management The purpose of this project is to reslope 20,000 linear feet of the backslope of the levees on the McCormack-Williamson tract (MWT) to a 5:1 slope using on-site fill to increase the strength and stability of the MWT levee system while increasing riparian habitat.	12/31/2008	\$2,476,835	Levee backslopes will be restored with riparian vegetation (3.79 miles).
ERP-02-P32	Distribution and Abundance of Shrimp, Plankton and Benthos in Suisun Marsh Evaluated the effects of alien species on the local community structure and investigated the influence that habitat type and environmental conditions have on the type and abundance of species present in the tidal marsh community. Sampled benthos, mysid, zooplankton.	10/31/2007	\$377,549	Complete.

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ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P45	Geomorphic and Geologic Mapping for Restoration Planning Mapped geomorphic landforms and geologic deposits along the lower Sacramento, San Joaquin, and Cosumnes Rivers for input into ecosystem restoration planning and levee engineering. Detailed mapping (1:24,000) completed for portions of nine 7.5 minute quadrangles.	6/1/2005	\$120,000	Complete.
ERP-04-S03	Integrated Regional Wetland Monitoring / Petaluma Marsh Expansion Project This project will monitor and evaluate the Petaluma Marsh Expansion Project as a secondary site within the Integrated Regional Wetland Monitoring Project (IRWM).	6/30/2009	\$235,000	Ongoing.
ERP-05D-C02	Suisun Marsh Implementation Plan Completed all the activities supporting the preparation of regional implementation plans in the Suisun Marsh.	6/30/2006	\$110,000	Complete.
ERP-96-M10	Applied Research to Predict Ecological Functions of Evolution of Restored Diked Wetlands Analyzed historically-breached dike wetlands in Delta as a means to predict the feasibility, patterns and rates of restoration to natural function that would be expected from breached-dike restoration strategies.	12/31/1999	\$475,000	Complete.
ERP-96-M26	Prospect Island Monitoring Plan Project A monitoring plan to evaluate the biological, chemical and physical effects of the Prospect Island Restoration Project was developed under this contract. Evaluated the extent of benefits of conversion of agricultural land to shallow water tidal habitat to aquatic, terrestrial and avian species.	6/30/1998	\$35,000	Complete.
ERP-97-B02	Monitor and Describe the Movement of Sediment Needed for Habitat Restoration in the Delta and Suisun Bay Described the movement and availability of sediment in the Delta, as needed for habitat restoration.	6/30/2001	\$1,047,010	Complete.
ERP-97-B03	Liberty Island Acquisition Protected and restored tidally influenced wetlands, riparian corridors, and upland habitats on Liberty Island in the Yolo Bypass.	9/30/2003	\$8,926,000	Completed acquisition of 4,760 acres of Liberty Island.
ERP-97-N10	Restoring Ecosystem Integrity in the Northwestern Delta - Jepson Prairie Restoration and Habitat Conservation Plan Restored habitat along two northwest Delta sloughs and adjacent perennial grasslands at Jepson Prairie.	9/30/2002	\$292,801	Complete. Converted 507 acres of agricultural grazing land to perennial grassland. Fenced 500 ft along the bank of Calhoun Cut and planted native plants to restore riparian and enhance Delta Sloughs.

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ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-N11	Demonstration Project for the Protection and Enhancement of Delta In-Channel Islands Demonstrated effective biotechnical methods to reduce erosion of in-channel islands and adjacent delta island banks.	5/29/2000	\$270,270	Complete.
ERP-97-N12	Franks Tract State Recreation Area Wetlands Habitat Restoration Conducted planning and preliminary engineering for the restoration of deeply flooded habitat to 45 acres of tidal perennial aquatic, shaded riverine aquatic, and mid channel island shoal and shoal habitats in Frank's Tract State Recreation Area (SRA).	12/31/2002	\$293,052	Complete.
ERP-97-N13	Tyler Island Levee Protection and Habitat Restoration Pilot Project Evaluated alternative vegetative and biotechnical techniques for stabilizing bank erosion restoring levees, as well as riparian and shallow water habitat.	5/31/2002	\$885,202	Completed work on 0.85 miles of Georgiana Slough and 0.57 miles of the North Fork Mokelumne River.
ERP-97-N16	Bay Point Shoreline Restoration Plan Developed a restoration plan for the Bay Point Regional Shoreline aimed a restoring tidal salt marsh habitat and ecosystem function.	10/31/2001	\$185,000	Complete.
ERP-97-N19	Tolay Creek Restoration Project Restored and enhanced 435 acres of saline emergent wetlands in the Tolay Creek floodplain for the benefit of threatened and endangered species.	9/17/2001	\$283,000	Complete.
ERP-98-B09	Integrated Pest Management Partnership to Improve Water Quality in Suisun Bay and Local Creeks Increased awareness of users to detrimental impacts of the use and disposal of pesticides and provide education and outreach of integrated pest management (IPM) improve water quality in the Suisun Bay and local creeks.	10/31/2001	\$273,276	Complete.
ERP-98-B34	Discover the Flyway Increased student awareness of wetlands and wildlife issues in the Yolo Basin.	12/31/2001	\$49,000	Complete. Enhanced seasonal wetland planting 3,000 native sedge/grass plugs.
ERP-98-B38	Water Hyacinth Education Program Distributed educational materials to Delta residents, which encourages waterway users to help achieve long-term control of hyacinth in the Delta region.	12/31/2001	\$9,598	Complete.
ERP-98-C01	Demonstration of Techniques for Reversing the Effects of Subsidence in the Sacramento-San Joaquin Delta: Phase 1 - Twitchell Island Evaluated techniques to reverse the subsidence of Delta islands.	12/31/2006	\$3,886,995	Complete.
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP Implementation of monitoring and applied research that provides data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.

Table 1. Tidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-E01	Napa River Watershed Stewardship Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/31/2000	\$250,000	Complete.
ERP-98-E03	San Francisco Bay Area Wetlands Ecosystem Goals Project Provided funds to enable the collection of data to be used in the creation of habitat goals which will be used by private, local, state, and federal entities seeking to protect and improve the San Francisco Bay Area's wetlands.	Unknown	\$76,000	Complete.
ERP-98-E11	Watershed Restoration Strategy for the Yolo Bypass Facilitated broadbased local stakeholder group in development of watershed plan.	3/31/2002	\$287,353	Complete.
ERP-98-E12	Lower Mokelumne River Watershed Stewardship Program (Phase I) Facilitated broadbased local stakeholder group in development of watershed plan, develop Environmental Farm plan and expand Neotropical bird monitoring for the Mokelumne River Watershed.	9/1/2000	\$159,000	Complete.
ERP-98-E14	American River (North and Middle Forks) Integrated Watershed Plan and Stewardship Strategy Developed a Watershed Management Plan and Stewardship Strategy to address a wide range of environmental, institutional, social, and economic issues for the watershed encompassing the North and Middle Forks of the American River.	12/31/2002	\$220,750	Complete.
ERP-98-E17	Alhambra Creek Watershed CRMP Program Developed a watershed management plan for the Alhambra Creek Watershed Plan using the Coordinated Resource Management Planning (CRMP) process. Also completed a Quality Assurance Project Plan (QAPP); A Users Manual; and Established Watershed Planning Group for public outreach.	4/30/2001	\$138,500	Complete.
ERP-98-F08	Hill Slough West Habitat Restoration Demonstration Project Completed the topographic surveys, hydrological evaluation, conceptual restoration plan, and monitoring plan for a multi-phased project to restore tidal action to seasonal and permanent wetlands in the Suisun Marsh at Hill Slough.	5/30/2002	\$200,000	Complete.
ERP-98-F09	Rhode Island Floodplain Management and Habitat Restoration - Phase I Evaluated floodplain and SRA habitat within/adjacent to Rhode Island in the eastern Delta for the purpose of restoring and improve floodplain functions and shallow water and riparian habitat.	6/30/2000	\$25,000	Complete.

Table 1. Tidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-F12	Stone Lakes NWR Land Acquisition Acquired fee title to approximately 537.35 acres of land within the boundary of the Stone Lakes National Wildlife Refuge to protect existing aquatic, wetland, and riparian habitats and restore a mosaic of aquatic, perennial and seasonal emergent wetland, riparian, and grassland habitats.	9/30/2003	\$2,626,505	Complete.
ERP-98-F13	Petaluma Marsh Expansion Project - Marin County Preserved a total of 181.46 acres of baylands west of the Petaluma River at the Marin-Sonoma County border by restoring and permanently protecting land for the benefit of several important species as part of the Petaluma Marsh, the largest undiked tidal marsh remaining in the Bay.	3/31/2004	\$503,635	Completed acquisition of 181.46 acres of baylands, restored 109.72 acres to Saline emergent wetland.
ERP-98-F16	Fern-Headreach Tidal Perennial Aquatic and Shaded River Aquatic Conservation Project Acquired permanent conservation easement for Fern-Headreach Island Complex on 168 acres along the main channel of the San Joaquin River in the Delta.	6/30/2000	\$425,000	Complete. Acquired 28 acres of shaded riverine aquatic habitat and 140 acres of shallow freshwater tidal perennial aquatic habitat.
ERP-98-F22	Biological Restoration and Monitoring in the Suisun Marsh/North San Francisco Bay Ecological Zone: An Ecosystem Approach to Improved Effectiveness of Bay/Delta Restoration Restored, maintained, and monitored two restoration projects (totaling 272 acres) in eastern San Pablo Bay and southern Suisun Bay with the objectives to restore emergent and immersed marshland, monitor the restored ecosystems, and improve restoration successes.	9/30/2001	\$772,667	Complete. Restored emergent and immersed marshland through increased tidal actions at two sites (totaling 272 acres: Tubbs 72 acres, Shell Marsh 200 acres). Habitats include: tidal perennial freshwater, saltwater tidal, instream aquatic and shaded riverine aquatic.
ERP-98-F23	South Napa River Tidal Slough and Floodplain Restoration Project First phase in restoring over 460 acres of wetlands in the South Napa River Tidal Slough. Acquired property, completed preliminary design work, an environmental feasibility study, and environmental compliance documentation and permitting.	6/30/2001	\$1,480,000	Complete. Acquired 453.24 acres. Habitats include: tidal perennial aquatic, saline emergent wetland, sloughs, seasonal wetlands, and perennial grasses.
ERP-99-B11	South Napa River Tidal Slough and Floodplain Restoration Project Phase 2 of the South Napa River Tidal Slough and Floodplain Restoration Project, which involved the restoration of tidal flow to 2.3 miles of historic slough habitat, and the restoration of nearly 483 acres of wetlands and uplands.	9/30/2005	\$1,520,000	Complete. Original and new habitats: perennial grasslands, saline emergent wetland, tidal perennial aquatic, tidal sloughs and seasonal wetlands.

Table 1. Tidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-B13	Understanding Tidal Marsh Restoration Processes and Patterns: Validating and Extending the "BREACH" Conceptual Model The inter-disciplinary team addressed considerable uncertainty in predicting the outcome and ecological benefit of restoring shallow-water tidal habitat in three different regions of the Bay Delta: the Delta, Suisun Bay, and San Pablo/North Bay.	6/30/2004	\$1,093,292	Completed refinement of conceptual models.
ERP-99-B18	An Evaluation of the Potential Impacts of the Chinese Mitten crab on the Benthic Communities in the Sacramento-San Joaquin Delta and Suisun Bay Provided information regarding the relationship between the Chinese mitten crab (<i>Eriocheir sinensis</i>) and the benthic invertebrate community within the Sacramento-San Joaquin Delta and Suisun Bay.	3/31/2003	\$178,764	Complete.
ERP-99-F09	Introduced Spartina Eradication Project Introduced Spartina Eradication Project (ISEP) is a regionally coordinated program with the primary objectives of preventing further spread of introduced Spartina species to the North Bay and Delta, preventing its introduction to new restoration projects and halting the degradation of CALFED priority habitat. The ISEP significantly reduced introduced Spartina in the San Francisco Bay estuary. Combined, more than 3,380 treated from 2004 to 2006, with a 60%-80% success rate. Includes work from ERP-99-F09 and ERP-01-C01.	9/30/2006	\$325,000	Complete. Significantly reduced or eliminated the estimated 1,930 acres of introduced Spartina in the San Francisco Bay estuary.
ERP-99-N03	East Delta Habitat Corridor, Tidal Marsh and Riparian Habitat Restoration Tidal marsh and riparian restoration project which improved habitat conditions along 14 miles of Georgiana Slough.	9/30/2003	\$1,100,000	Complete. Enhanced 0.57 stream miles of tidal perennial aquatic, and 7 stream miles of riparian; removal of NIS species, and finally protected an addition 1.5 stream miles of riparian.
ERP-99-N11	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Surveyed and mapped the non-native invasive plant species, purple loosestrife. Developed a site specific adaptive management plan and comprehensive local eradication and control efforts.	1/10/2003	\$139,473	Complete.
ERP-99-N11b	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Continued early detection, prevention and eradication/control work for purple loosestrife in the Phase I and Phase II areas (these phases were funded to ERP-99-N11 and ERP-99-F08).	12/31/2003	\$49,865	Complete.

Table 1. Tidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-N15	Lower Mokelumne River Watershed Stewardship Plan Program (Phase II/III) Completed preparation of the Lower Mokelumne River Watershed Stewardship Plan/Watershed Owner's Manual, Action Plan, and Monitoring and Evaluation Program and implemented the Initial Watershed Stewardship Actions.	6/30/2002	\$227,000	Complete.
ERP-99-N20	Napa River Watershed Stewardship Year 2 Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/30/2001	\$191,100	Completed hydrologic modeling, bank stabilization, Himalayan blackberry eradication, riparian enhancement and revegetation, spawning habitat improvement (0.05 stream miles, 0.25 acres).

Other Program Contributing to ERP Vision

Prospect Island, totaling 1,593 acres, has naturally developed tidal perennial aquatic habitat, but the amount has not been documented and is probably less than the 500 acres called for by the EMZ Target 1. Recently, in November 2007, USBR drained Prospect Island with plans to turn the island to DWR for restoration.

DFG has created a vegetation classification system for Delta, Suisun Bay, and Suisun Marsh that can be used as a basis for conservation actions called for in Stage 1 Expectations for Tidal Perennial Aquatic Habitat (Hickson and Keeler-Wolf 2007, Keeler-Wolf and Vaghti 2000).

Status of Topic Today

Stage 1 expectations have not been met. Specific numeric objectives with restoration objectives based on clearly stated conceptual models have not been formulated for each habitat type. Within and among habitat types, conservation and restoration activities have not been prioritized. ERP and the implementing agencies did complete many projects that provide slough habitat, although the projects were not based on priority, but rather opportunity. ERP made great progress in the Sacramento-San Joaquin Delta EMZ. In the future, subsidence and sea-level rise will, to a certain extent, dictate where tidal perennial aquatic habitat will be created. Delta Vision recommendations can serve as a guide to meeting or adjusting ERP goals for delta and tidal perennial aquatic habitat.

Planned Projects for Implementation

Dutch Slough Tidal Marsh Restoration Project (ERP-02-C07-D) estimates that it can restore up to 381 acres of Tidal Perennial Aquatic habitat in the Central and West Delta EMU). The Dutch Slough site was acquired by DWR in 2003. DWR and its partners have completed a restoration plan that is designed both to restore habitat and generate information about how best to restore Delta habitat in the future. The project is ready for implementation.

Impediments to Implementation

Microbial oxidation and compaction of organic-rich soils in the Delta have led to significant regional subsidence in the Delta and subsidence is likely to continue into the indefinite future, particularly in the central and west Delta (Mount and Twiss 2005). The combination of continuing subsidence and rising sea level makes attainment of ERP Tidal Perennial Aquatic targets for the central and west Delta more difficult than originally thought.

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4. HABITATS

4.2. Nontidal Perennial Aquatic Habitat

Introduction

Nontidal perennial aquatic habitat in the Bay-Delta estuary is present in certain low-elevation areas. Nontidal perennial aquatic habitat includes portions of permanent bodies of water that do not support emergent vegetation and that are not subject to tidal exchange, including lake, ponds, oxbows, gravel pits, and flooded islands. Although the size, quantity, and quality of existing nontidal perennial habitat do not equal the wildlife habitat values of sloughs and backwaters in the estuary before reclamation, these habitats are still important for many species of wildlife. In many places within the Delta, nontidal aquatic habitat has replaced the native tidal aquatic habitats. Outside the Delta, land reclamation has caused the substantial loss or degradation of nontidal aquatic area for many native fish and wildlife species.

Nontidal perennial aquatic habitats are important for many species of wildlife in the Delta. In many places within the Delta, nontidal aquatic habitat has replaced the native tidal aquatic habitats. Outside the Delta, the substantial loss or degradation of nontidal aquatic habitats associated with Central Valley wetlands has reduced the available habitat area for many native fish and wildlife species. Land reclamation is the major factor that limits the contribution of nontidal perennial aquatic habitats to the health of the Delta.

Applicable ERP Vision

Increase the area and improve the quality of existing open-water areas to provide high-quality habitat for waterfowl and other water birds.

Stage 1 Expectations

The expectation for Stage 1 was to develop a classification system for Delta, Suisun Bay, Suisun Marsh, and San Pablo Bay habitats that can be used as a basis for conservation actions. Specific, numeric objectives were to be formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. Within and among habitat types, conservation and restoration activities would be prioritized. Work was to begin on those projects given highest priority within a year of adoption of the strategic plan.

Changes Attributable to ERP

ERP carried out 17 projects that provided watershed planning, regional planning, and/or invasive species management in the support of nontidal perennial aquatic habitat in the Delta Ecological Management Zone (EMZ) and SFBSM EMZs. However, none of these projects have reported how much nontidal perennial aquatic they actually restored or enhanced.

Project Summary Table

Table 1. Nontidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-N30	Digital Soil Survey Mapping and Digital Orthophotoquad Imagery Development Made soils information more accessible to individuals and groups engaged in ecosystem restoration projects in the Bay-Delta Region, and in doing so, improved the ability of these projects to establishing habitat and supporting sustainable populations of valuable species.	8/15/2004	\$430,390	Complete.
ERP-02D-P54	Restoring Ecosystem Integrity in the Northwest Delta: Phase II Proposes to acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, north Delta tidal channels located west of the Yolo Bypass.	8/31/2008	\$1,781,658	Ongoing, acquisition of conservation easements on 1,100 acres of existing riparian, wetland and/or agricultural lands. Currently in the process of acquiring an agricultural easement on 292 acres.
ERP-02D-P68	Arundo Eradication and Coordination, Phase II This is Phase II of the <i>Arundo donax</i> eradication and coordination project. Phase II provides funding for ongoing monitoring and follow-up treatments for 5 Phase I projects, and adds 5 new partners. This project aims to remove approximately 273 acres of Arundo on over 63 miles of rivers and creeks.	3/15/2009	\$2,033,859	Ongoing, around eradication on 5 new sites: Gray Lodge Wildlife Area, Lindo Ck, Lower American R, San Joaquin R, Upper Cache Ck.
ERP-06D-S15	Sacramento River Conservation Area Forum (SRCAF) Funds efforts of the Sacramento River Conservation Area Forum to act as a coordinating body between local, state, and federal agencies regarding restoration activities in the Sacramento River watershed.	3/31/2010	\$656,277	Ongoing.
ERP-96-M13	Yolo Bypass Fish Habitat Examined the relationship between the Yolo Bypass and the rest of the Estuary and developed recommendations for restoration actions that would improve habitat for fisheries and other aquatic organisms in the Yolo Bypass.	11/3/2000	\$226,000	Complete.

Table 1. Nontidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-B34	Discover the Flyway Increased student awareness of wetlands and wildlife issues in the Yolo Basin.	12/31/2001	\$49,000	Complete, enhanced seasonal wetlands planting 3,000 native sedge/grass plugs.
ERP-98-B38	Water Hyacinth Education Program Distributed educational materials to Delta residents, which encourages waterway users to help achieve long-term control of hyacinth in the Delta region.	12/31/2001	\$9,598	Complete.
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP Implementation of monitoring and applied research that provides data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.
ERP-98-E01	Napa River Watershed Stewardship Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/31/2000	\$250,000	Complete.
ERP-98-E02	Sonoma Creek Watershed Enhancement Plan - Phase II Assisted in implementing restoration, monitoring, and educational outreach actions in the Sonoma Creek Watershed aimed at restoring the watershed through collaboration with a combination of public and private organizations.	12/31/2000	\$302,000	Complete. Fenced riparian corridors, stabilize eroding streambanks, provided enhancement planting, and generally worked to reduce sediment sources over 3.52 miles.
ERP-98-E11	Watershed Restoration Strategy for the Yolo Bypass Facilitated broad based local stakeholder group in development of watershed plan.	3/31/2002	\$287,353	Complete.
ERP-98-E12	Lower Mokelumne River Watershed Stewardship Program (Phase I) Facilitated broad-based local stakeholder groups in development of watershed plan, developed Environmental Farm plan and expanded Neotropical bird monitoring for the Mokelumne River Watershed.	9/1/2000	\$159,000	Complete.
ERP-98-E14	American River (North and Middle Forks) Integrated Watershed Plan and Stewardship Strategy Developed a Watershed Management Plan and Stewardship Strategy to address a wide range of environmental, institutional, social, and economic issues for the watershed encompassing the North and Middle Forks of the American River.	12/31/2002	\$220,750	Complete.
ERP-99-N11	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Surveyed and mapped the non-native invasive plant species, purple loosestrife. Developed a site-specific adaptive management plan and comprehensive local eradication and control efforts.	1/10/2003	\$139,473	Complete.

Table 1. Nontidal Perennial Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-N11b	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Continued early detection, prevention and eradication/control work for purple loosestrife in the Phase I and Phase II areas (these phases were funded to ERP-99-N11 and ERP-99-F08).	12/31/2003	\$49,865	Complete.
ERP-99-N15	Lower Mokelumne River Watershed Stewardship Plan Program (Phase II/III) Continuation of a previously funded project by completing preparation of the Lower Mokelumne River Watershed Stewardship Plan/Watershed Owner's Manual, Action Plan, and Monitoring and Evaluation Program, and implemented the Initial Watershed Stewardship Actions.	6/30/2002	\$227,000	Complete.
ERP-99-N20	Napa River Watershed Stewardship Year 2 Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/30/2001	\$191,100	Complete. Hydrologic modeling. Multiple habitats enhanced. Eroding bank stabilization, Himalayan blackberry eradication, riparian enhancement and revegetation, spawning habitat improvement (0.05 stream miles, 0.25 acres).

Other Programs Contributing to ERP Vision

The DFG has created a vegetation classification system for the Delta, Suisun Bay, and Suisun Marsh that can be used as a basis for conservation actions (Hickson and Keeler-Wolf 2007, Keeler-Wolf and Vaghti 2000).

Feyrer et al. 2004 assessed the likelihood of enhancing native fish populations by means of floodplain restoration projects, habitat characteristics and fish assemblages of seven perennial floodplain ponds in the Yolo Bypass, during the summer 2001. They found all ponds were eutrophic, based upon high chlorophyll *a* or dissolved nutrient concentrations. Relatively large shallow ponds generally exhibited higher specific conductivity and dissolved phosphorus concentrations than small deep ponds, which exhibited greater water transparency and total dissolved nitrogen concentrations. Furthermore, all ponds were dominated by alien fishes; only three native species, contributing <1% of the total number of individuals and <3% of overall biomass, were captured. They found that fish assemblage structure varied among ponds, notably between engineered vs. natural ponds, and was related to specific conductance, total dissolved solids and water transparency.

Status of Topic Today

Subsidence and sea-level rise will exert a major influence on where ERP creates nontidal perennial aquatic habitat in the Delta. Microbial oxidation and compaction of organic-rich soils in the Delta have led to significant regional subsidence in the Delta and subsidence is likely to continue into the indefinite future, particularly in the central and west Delta (Mount and Twiss 2005). The combination of continuing subsidence and rising sea level makes attaining ERP Delta slough targets for the central and west Delta more difficult than originally thought.

ERP needs to complete a classification system for the Delta, Suisun Bay, Suisun Marsh, and San Pablo Bay habitats to use as a basis for conservation actions. Specific numeric objectives must be formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. ERP should prioritize conservation and restoration activities within and among habitat types.

Planned Projects for Implementation

None.

Impediments to Implementation

None.

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- CALFED (CALFED Bay-Delta Program). 2000a. Ecosystem Restoration Program Plan Volume I: Ecological Attributes of the San Francisco Bay-Delta Watershed. CALFED, Final Programmatic EIS/EIR Technical Appendix. Sacramento, CA.
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- Feyrer, F., T. R. Sommer, S. C. Zeug, G. O'Leary and W. Harrell. 2004. Fish Assemblages of Perennial Floodplain Ponds of the Sacramento River, California (USA), with Implications for the Conservation of Natives Fishes. *Fisheries Management and Ecology*. 11:335-344.
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4. HABITATS

4.3. Delta Sloughs

Introduction

Delta sloughs are tidal channels that once extensively connected rivers to the Bay through the Delta marshes. These low-velocity, natural tributaries of Delta rivers vary in depth and width, have gently sloped, vegetated sides, and are connected to the Delta. Delta Sloughs are a component of tidal perennial aquatic habitat that includes deepwater slough areas, those areas that are greater than 3 meters deep from mean low low tide, and shallow slough areas, those areas that are less than or equal to 3 meters deep from mean low low tide.

Most of the Delta sloughs were lost when the islands were reclaimed by construction of levees. Many smaller Delta sloughs were lost in the past several decades when levees severed them from main channels. Levee construction and maintenance has reduced the habitat value of many of the remaining natural sloughs. Boat traffic has also led to shoreline erosion and associated loss of shallow water, marsh, and riparian habitat.

Delta sloughs provide various beneficial habitats. They offer protection to plants, fish, and wildlife from wind and high-velocity flows. Delta sloughs also support floating aquatic plant communities, which are otherwise found only in small, sheltered pockets along open channels. The seasonal succession of native floating plants in sloughs is a valuable link in the estuary's food chain. First to appear is duckweed, which provides primary food production for insect larvae, crustaceans, waterfowl and other birds. The duckweed community creates conditions favorable to water fern establishment. The water fern spores contain a bacterium that photosynthesizes and fixes (stores) nitrogen, which allows the water ferns to establish in nitrogen-deficient waters. Aquatic plants in sloughs provide protective cover and habitats for fish, insects, and birds, and an abundance of food organisms. Wildlife use varies with the amount of open water and marsh, the extent and type of vegetation present, and surrounding land uses.

Sloughs provide warmer, highly productive habitat for seasonal spawning, rearing, and foraging for many aquatic organisms, as well as important organic carbon productivity for all habitats of the Bay-Delta. Unlike leveed river channels, sloughs have marsh and riparian fringes with shallow water and natural shaded riverine aquatic habitat, providing shallow, low-velocity refuge habitat for many native fishes. Several resident species of Delta fish live in sloughs, and splittail and delta smelt may use them for spawning. Marsh and riparian corridors along sloughs are important for breeding, feeding, resting, and roosting waterfowl.

Applicable ERP Vision

The vision for Delta sloughs is to increase the area and improve the quality of interconnected dead-end and open-ended Delta sloughs to assist in the recovery of special-status fish and wildlife populations, provide shallow water habitats for fish spawning and rearing, and provide aquatic, wetland, and riparian habitat for wildlife.

Stage 1 Expectations

Stage 1 expectations were to develop a classification system for the Delta, Suisun Bay, Suisun Marsh, and San Pablo Bay habitats that can be used as a basis for conservation actions will have been developed. Specific, numeric objectives were to be formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. Within and among habitat types, conservation and restoration activities were to be prioritized. Work would begin on those projects given highest priority within a year of adoption of the strategic plan.

Changes Attributable to ERP

In the Suisun Marsh/North San Francisco Bay EMZ, ERP created a reported 3.48 miles of tidal sloughs (12% of the 30-mile general target). However, not all projects tracked the amount of slough habitat created or restored, nor did ERP track work done by other organizations in concert with the implementing agencies. Conservation entities, including the Sonoma Land Trust and the San Francisco Bay Joint Venture, are actively implementing acquisition, preservation and restoration strategies in Suisun Marsh/North San Francisco Bay EMZ. ERP acquired approximately 9,850 acres of former salt ponds in the Napa River EMU since the initial Stage 1 implementation planning. ERP acquired another 2,000 acres of baylands diked for agriculture. ERP acquired approximately 595 acres of the total 12,100 acres. ERP funds were instrumental in restoring tidal circulation to 3,595 acres of formerly diked baylands in the estuarine reach of the Napa River. Hence, ERP met the 10-20 mile target for restoration of sloughs in the Napa River EMU. The American Canyon Wetlands project restored approximately 3 miles of tidal slough. Restoration projects created numerous starter channels in the American Canyon, Salt Pond and South Napa River restoration sites. The potential for slough development within the breached sites contributes to the slough restoration target. Prior to the drafting of Stage 1 plans, various projects acquired extensive areas of marsh and uplands in the Sonoma Creek EMU. However many of these areas are not scheduled for restoration in the near future. Many of the acquired lands are subsided and the position of Highway 37 in the landscape is a major impediment to reconnection of the diked baylands to San Pablo Bay, the historic tidal connection.

The monitoring on *Tolay Creek (Ecological Monitoring of Tolay & Cullinan Ranch Tidal Wetlands Restoration (ERP-01-N19))* confirms that some species have benefited from ERP funded activities. However, mature tidal marsh tends to have lower diversity and abundance of water birds due to the general lack of open water habitat. For this reason, local land managers do not plan to convert all of the sub-tidal land in the lower reaches of Sonoma and Tolay Creeks back to saline marsh habitat. Much of the already acquired acreage will be managed to preserve perennial open water habitat.

Understanding Tidal Marsh Restoration Processes and Patterns: Validating and Extending the "BREACH" Conceptual Model (ERP-99-B13) found that fish species assemblages increasingly resemble reference site assemblages in restored marshes approaching eight years maturity. The fish species assemblage trends in mature restored marshes were towards increasing percentages of native fish species. Delta Smelt use the Napa River and in recent years it has produced springtime smelt for the 20 mm survey in numbers close to the catch in the Delta. This year (2007), when smelt capture numbers in the Delta were alarmingly low, no smelt were captured in the Napa River stations.

To discern the effect of this loss and the ecological contribution of the remaining tidal marsh habitat in the *San Francisco Estuary, Distribution and abundance of shrimp, plankton and benthos in Suisun Marsh (ERP-02-P32)* investigated the productivity of tidal channels in Suisun Marsh. Schroeter and Moyle (2006) found several regions of high productivity within the interior of the marsh, likely due to high residence time of water, nutrient availability, and absence of alien clams. In contrast, they also found that the surrounding bay and river channel habitats had very low levels of primary production. Invertebrates, including mesozooplankton and benthos are most abundant within the interior sloughs and channels, often reaching very high densities. macrozooplankton abundance patterns were more variable, but are also high within the marsh interior and rivers with declines observed in some bay and large slough habitats. These data suggest that Suisun Marsh plays a significant role in estuarine productivity by providing an abundant source of primary production and pelagic invertebrates, both of which are depleted in bay and river channel habitats. These localized areas of high productivity may transfer benefits up the food chain, as fish abundance for select species remains high in the tidal marsh sloughs despite considerable declines observed elsewhere in the San Francisco Estuary. There is little evidence that this productivity is directly transported to the exterior bay and channel habitats, although migratory invertebrates and fish may export considerable quantities of biomass from the marsh through their movements (Schroeter and Moyle 2006).

In the Sacramento-San Joaquin Delta EMZ, on a large portion of 5,209 acre Liberty Island, various habitats, including tidal perennial aquatic, delta sloughs, freshwater emergent wetland, and riparian and riverine aquatic habitats, are being passively restored. Nearly 800 acres of fresh and saline tidal emergent wetlands, and 130 acres

of valley-foothill riparian have developed naturally since 1997 (Hickson and Keeler-Wolf 2007). Prospect Island has approximately 768 acres of naturally developed fresh and saline tidal emergent wetlands, and 320 acres of valley-foothill riparian habitat (Hickson and Keeler-Wolf 2007). Other ERP projects in the Sacramento-San Joaquin Delta EMZ protected and/or enhanced 3.39 miles of Delta sloughs (2% of the general target, 160 miles).

On Liberty Island, delta slough habitat is populated with otters, beaver, muskrat and numerous species of ducks and geese. Native fish species found include Chinook salmon, splittail, longfin and delta smelt, tule perch, Sacramento pike minnow, starry flounder and others. In some areas, native species account for up to 21% of the samples. Gravid delta smelt have been collected as late as May and adhesive smelt eggs have been observed on submerged woody debris. Wilder et al. (2006) studied the spatial and temporal patterns in use of Liberty Island by larval, juvenile, and adult fishes. In three years of sampling using multiple gear types, they collected 40 species of fish: 18 native and 22 non-native. They found that native larvae were more abundant than non-native, whereas non-native juveniles and adults were more abundant than natives. No clear spatial patterns in native larval abundance existed, although non-natives were more abundant in the northern portion of the island. There were also no clear patterns for native juveniles, but non-natives were more abundant on the west side of the island. Furthermore, they found native and non-native adults were more abundant on the east side of the island. Intra-annual patterns were similar for larvae and juveniles: natives were more abundant earlier (January-June) than non-natives (May-September). Wilder et al. (2006) also found adult natives were most abundant in fall/winter, while non-natives were most abundant in spring/summer. These results indicate that fish clearly utilize habitat in Liberty Island, and that spatial and temporal preferences among life stages and between natives and non-natives exist.

Project Summary Table

Table 1. Delta Sloughs Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-F06	Liberty Island Acquisition Acquired fee title interest in the remaining two privately-owned properties on Liberty Island, estimated at 449 acres; and to conduct restoration of tidal shallow water habitat, tidal emergent wetlands, and seasonal wetlands for aquatic and terrestrial species.	9/30/2007	\$2,625,153	Complete.

Table 1. Delta Sloughs Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-F08	McCormack-Williamson Tract Restoration Planning, Design and Monitoring Program I Performed baseline studies necessary for project planning and design, and the development of long-term monitoring programs of the McCormack-Williamson Tract (M-W), which is a 1,600-acre Delta island.	8/1/2003	\$556,200	Complete.
ERP-01-C01	Invasive <i>Spartina</i> Project Expanded effort to plan and implement control measures for <i>Spartina alterniflora</i> , contribute to the overall scientific understanding of the species, and build a bay-wide infrastructure to detect and prevent its future invasions.	10/31/2006	\$1,793,661	Complete.
ERP-01-C04	Suisun Marsh Property Acquisition & Habitat Restoration Acquired property in the Suisun Marsh, along Hill Slough, restored to a fully functioning self-sustaining tidal wetland ecosystem which includes low-marsh, high-marsh, and upland transition zones, increasing the area and contiguity of saline emergent wetlands thereby assisting in the recovery of at-risk species.	6/30/2006	\$536,750	Complete. Acquired Blacklock parcel (69 acres).
ERP-01-C09	Hill Slough West Habitat Restoration Demonstration Project, Phase II Completed the environmental documentation and permitting for a multi-phased project to restore tidal action to seasonal and permanent wetlands in the Suisun Marsh.	11/30/2006	\$87,000	Complete.
ERP-01-N19	Ecological Monitoring of Tolay & Cullinan Ranch Tidal Wetlands Restoration Monitored the Tolay Creek (ERP-97-N19) and Cullinan Ranch (ERP-97-N18) Tidal Wetland Restoration Projects in the North San Francisco Bay.	6/30/2006	\$593,931	Complete.
ERP-01-N38	Delta Studies Program: San Joaquin County Schools Increased student and teacher knowledge at sixty targeted schools in San Joaquin County. The program developed a Delta Studies Curriculum, developed and maintained a Delta Education Resource Center, and recruited, identified, trained, and supported a cadre of thirty teacher leaders each per years Two and Three called Delta Educational Leaders for Teaching and Action (DELTA).	6/30/2004	\$323,198	Complete.
ERP-01-N41	Bay-Delta Learning Initiative Produced and distributed educational posters, directed at boaters and anglers, to teach them about plant and pest non-native invasive species; and provided the media with an overview of current topics and provided workshops and teaching materials for teachers for greater awareness of and appreciation for the Bay-Delta ecosystem.	3/31/2004	\$126,668	Complete.
ERP-02-C07-D	Dutch Slough Tidal Marsh Restoration Project (Phase I) Acquired the three contiguous parcels totaling 1,166 acres that comprise the Dutch Slough site	12/31/2006	\$23,550,000	Complete.

Table 1. Delta Sloughs Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02D-P54	Restoring Ecosystem Integrity in the Northwest Delta: Phase II Proposes to acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, north Delta tidal channels located west of the Yolo Bypass.	8/31/2008	\$1,781,658	On going, acquisition of conservation easements on 1,100 acres of existing riparian, wetland and/or agricultural lands. Currently in the process of acquiring an agricultural easement on 292 acres.
ERP-02D-P71	Napa-Sonoma Marsh Restoration Project - Construction Phase (Ponds 3,4, and 5) Phase I of the Napa-Sonoma Marsh restoration project, a Federal USACE project which entailed the restoration of three former commercial salt ponds along the Napa River, totaling approximately 3,000 acres.	6/30/2007	\$3,203,000	Complete. Restored Pond 3 (1,300 ac) to tidal marsh and associated marsh habitat. Breached levees on ponds 4 and 5 (combined 1,700 ac) for salinity reduction in preparation for restoration.
ERP-02-P03-D	Dutch Slough Restoration Project Developed a restoration plan for a 1,166 acre site adjacent to Dutch Slough and the mouth of Marsh Creek in the western Delta.	11/2/2008	\$1,500,000	Ongoing.
ERP-02-P04-D	Napa-Sonoma Marsh Restoration Project Restoration of three former commercial salt ponds along the Napa River, totaling approximately 3,000 acres, to tidal marsh. It is a phase of the Napa-Sonoma Marsh restoration project, a Federal USACE project. Phase I will provide for restoration of Pond 3 (1,300 acres) to tidal habitats, and salinity reduction in preparation for tidal habitat restoration in Ponds 4 and 5 (1,700 acres).	11/7/2006	\$1,339,000	This project would have had some restoration measures, but according to the last two quarterly reports, task 5 (Construction) has been deleted from the project by amendment # 1 to ERP-02-P04D (S-02-RA-017) and handed over to the Wildlife Conservation Board.
ERP-02-P12	Sustainable Restoration Technologies for Bay/Delta Tidal Marsh and Riparian Habitat Protection of natural embankment and reconstruction through passive recruitment of new sediment to create new riparian and shaded riverine aquatic habitat in aquatic channels.	12/30/2006	\$1,800,000	Completed 3.72 river miles (1.99 miles in East Delta, 0.5 miles in North Delta, 0.81 miles in Central and West Delta, 0.42 miles in the Suisun Marsh and Bay) of restored riverbank, levee and shoreline tidal environments to riparian and marsh habitats.
ERP-02-P14	Bahia Acquisition and Tidal Wetland Restoration Will acquire the 631 acre Bahia site, which consists of historic tidal wetlands and adjacent uplands, and the restoration of the former wetlands to tidal marsh by developing a plan to restore 330 acres of currently diked wetlands to tidal action and implementing that plan.	6/1/2009	\$3,345,000	Ongoing.

Table 1. Delta Sloughs Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P21	Restoring Ecosystem Integrity in the Northwest Delta: PHASE II Manage and restore up to 1,300 acres of perennial grassland/vernal pool complex in Solano County, CA, and develop a management plan for the Pembco property or other acquisition within the JPP Island Corridor.	8/31/2008	\$246,370	Ongoing.
ERP-02-P32	Distribution and abundance of Shrimp, Plankton, and Benthos in Suisun Marsh Study objectives to evaluate relationships between the presence of alien species on community structure and to investigate the influence that habitat type and environmental conditions have on species type and abundance.	10/31/2007	\$271,804	Ongoing.
ERP-04-S02	Monitoring for Invasive <i>Spartina</i> Control in the San Francisco Estuary Provides timely, high quality data regarding the location and extent of invasive <i>Spartina</i> to the San Francisco Estuary Invasive <i>Spartina</i> Project, so that it may plan and rapidly implement cost-effective weed control measures and determine when site-specific and regional control objectives have been met. In addition, the Monitoring Program will provide accurate data on the status of endangered California clapper rails at the <i>Spartina</i> treatment sites, to allow <i>Spartina</i> control to be implemented with minimum adverse effects on rails.	12/31/2008	\$1,234,396	Ongoing.
ERP-96-M26	Prospect Island Monitoring Plan Project A monitoring plan to evaluate the biological, chemical and physical effects of the Prospect Island Restoration Project was developed under this contract. The monitoring plan evaluated the extent of benefits of conversion of agricultural land to shallow water tidal habitat to aquatic, terrestrial and avian species.	6/30/1998	\$35,000	Complete.
ERP-97-B02	Monitor and Describe the Movement of Sediment Needed for Habitat Restoration in the Delta and Suisun Bay Described the movement and availability of sediment in the Delta, as needed for habitat restoration.	6/30/2001	\$1,047,010	Complete.
ERP-97-B03	Liberty Island Acquisition Protected and restored tidally influenced wetlands, riparian corridors, and upland habitats on Liberty Island in the Yolo Bypass.	9/30/2003	\$8,926,000	Completed acquisition of 4,760 acres of Liberty Island.
ERP-97-N10	Restoring Ecosystem Integrity in the Northwestern Delta - Jepson Prairie Restoration and Habitat Conservation Plan Restored habitat along two northwest Delta sloughs and adjacent perennial grasslands at Jepson Prairie.	9/30/2002	\$292,801	Complete. Converted 507 acres of agricultural grazing land to perennial grassland. Fenced 500 ft along the bank of Calhoun Cut and planted native plants to restore riparian and enhance Delta Sloughs.

Table 1. Delta Sloughs Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-N16	Bay Point Shoreline Restoration Plan Developed a restoration plan for the Bay Point Regional Shoreline aimed at restoring tidal salt marsh habitat and ecosystem function.	10/31/2001	\$185,000	Complete.
ERP-97-N18	Cullinan Ranch Restoration Part 1 of a larger effort, aims at restoring tidal salt marsh habitat and ecosystem function in Cullinan Ranch. Prepared environmental permits and designed engineering plans to restore 1,495 acres of saline emergent wetland habitat by supplying the necessary sediments through accretion to restore proper tidal elevation gradients at the project site.	6/17/2004	\$368,500	Complete. Planning, due to unexpected analysis, coordination and design of the Cullinan Ranch Tidal Restoration Project, construction activities could not be initiated during the grant period.
ERP-97-N19	Tolay Creek Restoration Project Restored and enhanced 435 acres of saline emergent wetlands in the Tolay Creek floodplain for the benefit of threatened and endangered species.	9/17/2001	\$283,000	Complete.
ERP-98-B13	South Napa River Wetlands Acquisition Addressed considerable uncertainty in predicting the outcome and ecological benefit of restoring shallow-water tidal habitat in three different regions of the Bay Delta: the Delta, Suisun Bay, and San Pablo/North Bay.	9/30/2000	\$1,073,513	Complete. Acquired and restored 68 acres. Habitats: seasonal connected wetland, riparian and riverine aquatic - riparian & instream, saline emergent wetlands.
ERP-98-B34	Discover the Flyway Increased student awareness of wetlands and wildlife issues in the Yolo Basin.	12/31/2001	\$49,000	Complete, enhanced seasonal wetland planting 3,000 native sedge/grass plugs.
ERP-98-C03	Hamilton Wetlands Restoration Planning Planning and environmental documentation for the restoration of 2,500 acres of subsided, diked baylands to a mix of seasonal and tidal wetlands.	6/30/2002	\$1,070,030	Complete.
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP Implementation of monitoring and applied research that provides data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.
ERP-98-E01	Napa River Watershed Stewardship Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/31/2000	\$250,000	Complete.

Table 1. Delta Sloughs Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-E04	Petaluma River Watershed Restoration Program Provided funds to implement the restoration and monitoring projects identified in the Petaluma River Watershed Enhancement Plan with the goal of enhancing and restoring habitat and ecosystem function along the Petaluma River.	2/28/2001	\$220,000	Complete. Willowbrook/Lichau Creek reduced habitat fragmentation by reestablishing riparian vegetation along 3,000ft of stream. San Antonio Creek stabilized 1,000ft of streambank and planted native vegetation along 2,000ft of streambank. Habitat restored: saline emergent wetlands, riparian and riverine aquatic - instream. (0.76 miles total)
ERP-98-F08	Hill Slough West Habitat Restoration Demonstration Project Completed the topographic surveys, hydrological evaluation, conceptual restoration plan, and monitoring plan for a multi-phased project to restore tidal action to seasonal and permanent wetlands in the Suisun Marsh at Hill Slough.	5/30/2002	\$200,000	Complete.
ERP-98-F13	Petaluma Marsh Expansion Project - Marin County Preserved a total of 181.46 acres of baylands west of the Petaluma River at the Marin-Sonoma County border by restoring and permanently protecting land for the benefit of several important species as part of the Petaluma Marsh, the largest un-diked tidal marsh remaining in the Bay.	3/31/2004	\$503,635	Complete. Acquired 181.46 acres of baylands, restored 109.72 acres to saline emergent wetland.
ERP-98-F17	Benicia Waterfront Marsh Restoration Project Phase 1, final planning and permitting for the restoration of 8 acres of degraded salt marsh habitat along the Benicia waterfront in downtown Benicia for the benefit of several important plant and animal species.	2/28/2001	\$59,000	Complete.
ERP-98-F22	Biological Restoration and Monitoring in the Suisun Marsh/North San Francisco Bay Ecological Zone: An Ecosystem Approach to Improved Effectiveness of Bay/Delta Restoration Restored, maintained, and monitored two restoration projects (totaling 272 acres) in eastern San Pablo Bay and southern Suisun Bay with the objectives to restore emergent and immersed marshland, monitor the restored ecosystems, and improve restoration successes.	9/30/2001	\$772,667	Complete. Two sites (totaling 272 acres: Tubbs 72 acres, Shell Marsh 200 acres). Habitats include: tidal perennial freshwater, saltwater tidal, in-stream aquatic and shaded riverine aquatic.
ERP-98-F23	South Napa River Tidal Slough and Floodplain Restoration Project First phase in restoring over 460 acres of wetlands in the South Napa River Tidal Slough. Funded acquisition of the property, preliminary design work, an environmental feasibility study, and environmental compliance document	6/30/2001	\$1,480,000	Complete. Acquired 453.24 acres. Habitats include: tidal perennial aquatic, saline emergent wetland, sloughs, seasonal wetlands, and perennial grasses.

Table 1. Delta Sloughs Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-B11	South Napa River Tidal Slough and Floodplain Restoration Project Phase 2 of the South Napa River Tidal Slough and Floodplain Restoration Project, which involved the restoration of tidal flow to 2.3 miles of historic slough habitat, and the restoration of nearly 483 acres of wetlands and uplands.	9/30/2005	\$1,520,000	Complete. Original and new habitats: perennial grasslands, saline emergent wetland, tidal perennial aquatic, tidal sloughs and seasonal wetlands.
ERP-99-B13	Understanding Tidal Marsh Restoration Processes and Patterns: Validating and Extending the "BREACH" Conceptual Model Addressed considerable uncertainty in predicting the outcome and ecological benefit of restoring shallow-water tidal habitat in three different regions of the Bay Delta: the Delta, Suisun Bay, and San Pablo/North Bay.	6/30/2004	\$1,093,292	Complete. Refinement of conceptual models.
ERP-99-B18	An Evaluation of the Potential Impacts of the Chinese Mitten crab on the Benthic Communities in the Sacramento-San Joaquin Delta and Suisun Bay Provided information regarding the relationship between the Chinese mitten crab (<i>Eriocheir sinensis</i>) and the benthic invertebrate community within the Sacramento-San Joaquin Delta and Suisun Bay.	3/31/2003	\$178,764	Complete.
ERP-99-N11	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Surveyed and mapped the non-native invasive plant species, purple loosestrife. Developed a site specific adaptive management plan and comprehensive local eradication and control efforts.	1/10/2003	\$139,473	Complete.
ERP-99-N11b	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Continued early detection, prevention and eradication/control work for purple loosestrife in the Phase I and Phase II areas (these phases were funded to ERP-99-N11 and ERP-99-F08).	12/31/2003	\$49,865	Complete.

Other Programs Contributing to ERP Vision

In line with the Stage 1 Expectations, DFG has created a vegetation classification system for the Delta, Suisun Bay, and Suisun Marsh that helps the monitoring of conservation actions (Hickson and Keeler-Wolf 2007, Keeler-Wolf and Vaghti 2000).

The Napa River Fisheries Monitoring Program documented fish species composition, life stage, seasonality, and environmental conditions associated with fishes' use of habitat created by the ACOE Napa River/Napa Creek Flood Protection Project (Wilcox et al. 2006). By breaching levees along the Napa River, the Corps created riverside marsh

terraces, restoring tidal wetlands and floodplains from formally diked pasture land. Restoration of the area provides habitat for a variety of native and non-native fish species. Sampling efforts over five years (spring and summer of 2001 to 2005) captured 37 different species. Surveys indicate that: 1) juvenile Sacramento splittail abundance is positively correlated with salinity in created/restored habitat; 2) juvenile Sacramento splittail were more abundant in shallow created/restored habitat, especially marsh plain habitat, than surrounding deep non-restored habitat; 3) striped bass abundance is positively correlated with salinity; and 4) and relative abundance varied annually for inland silverside, threadfin shad, Pacific herring, and Sacramento splittail. Variability in species assemblages reflects changes in environmental conditions (e.g. salinity, temperature) and possibly successional changes in created flood and marsh plain habitat. Currently, the created and restored areas do not appear to be benefiting native species more than non-native species. The created marsh plain may have greater potential for native species such as Sacramento splittail, based on higher abundance and CPUE for splittail in marsh plain areas.

Status of Topic Today

The CALFED Science Program and the Interagency Ecological Program for the San Francisco Estuary (IEP) have been investigating the benefits of shallow water habitat in the Delta (which Delta and tidal sloughs contain or a part). There is growing body of evidence that shallow habitats dominated by submerged macrophytes are generally unsuitable for the Delta's remnant native fish fauna (Nobriga and Feyrer 2007). Nobriga and Feyrer (2007) strongly suggest that restoration projects in the Delta need to discourage submerged macrophyte domination regardless of what mechanisms are primarily responsible for low native fish use. Furthermore Moyle et al. (2007) points out that permanent water on Central Valley floodplains, such as that found in sloughs, also supports mainly alien resident fishes, which may be significant predators on juvenile native fishes, or otherwise alter the system in unfavorable ways. Thus, according to Moyle et al. (2007), it is desirable to reduce such habitats as much as possible or to find ways to make them more favorable for native fishes.

The CALFED Science Program supported additional research into subsidence in the Delta. Microbial oxidation and compaction of organic-rich soils in the Delta have led to significant regional subsidence in the Delta and subsidence is likely to continue into the indefinite future, particularly in the central and west Delta (Mount and Twiss 2005). The combination of continuing subsidence and rising sea level makes attaining ERP Delta slough targets for the central and west Delta more difficult than originally thought. Subsidence and sea-level rise will, to a certain extent, dictate where marsh habitat and the associated delta and tidal sloughs will be created.

On-the-ground ERP projects, and actions taken by the implementing agencies and conservation groups to restore tidal wetlands, likely increased the amount of tidal and

delta sloughs. However, without additional monitoring and a full account of all conservation and restoration activities, it is difficult to determine how species have benefited from ERP-funded activities.

Specific, numeric objectives have not yet been formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. Within and among habitat types, conservation and restoration activities still need to be prioritized.

ERP and the implementing agencies did complete many projects that provide slough habitat. However, this has not been based on a given priority list, but rather opportunity. ERP made a great amount of progress in the Suisun Marsh/North San Francisco Bay EMZ, but less progress in the Sacramento-San Joaquin Delta EMZ.

Planned Projects for Implementation

Delta Vision recommendations could serve as a guide to meeting or adjusting ERP goals for Delta and tidal slough habitat (Delta Vision Blue Ribbon Task Force 2007).

Impediments to Implementation

A major impediment to creation or restoration of Delta and tidal sloughs is the subsidence of many of the areas that were formally marshes. This is particularly true in the central and west Delta where much of the land is severely subsided; some areas are subsided more than 8 meters.

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4. HABITATS

4.4. Midchannel Islands and Shoals

Introduction

The Delta formerly supported broad expanses of tule marshes, riparian forests, and shallow-water habitats. Today, intensive agricultural production on levee-bounded islands has replaced most of these habitats. Delta islands are separated by steep-banked waterways, which provide few shallow-water areas where natural vegetation can take root. Natural vegetation is generally limited to midchannel islands and a narrow band along levee edges. In many areas, even this remaining band of vegetation has been displaced by bank protection. Cumulative loss of natural vegetation has a detrimental impact on the Delta's fish and wildlife populations.

Midchannel islands and shoals in the Delta are the remnants of naturally occurring islands that existed prior to reclamation or are remnants of natural or old levees. The islands are the surviving examples of an expansive tule marsh with largely shallow and diffuse channels separating the stands. Early efforts to convert the Delta islands into agricultural lands included dredging near these islands for material to form levees. While converting the marsh to agriculture lands, naturally meandering channels were straightened, resulting in the creation of tule islands. In other areas, the distance between levees was wide and marsh was left between the levees.

Applicable ERP Vision

The vision for midchannel islands and shoals is to increase and enhance the area and protect the quality of existing habitat for fish and wildlife dependent on the Bay-Delta.

Stage 1 Expectations

Stage 1 expectations were to develop a classification system for Delta, Suisun Bay, Suisun Marsh, and San Pablo Bay habitats that could be used as a basis for conservation actions. Specific, numeric objectives were to be formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. Within and among habitat types, conservation and restoration activities were to be prioritized. Work would have begun on those projects given highest priority within a year of adoption of the strategic plan.

Channels or channel reaches most suited for restoration and protection of shallow water habitats were to be identified and given priorities for restoration activities. Detrimental

human activities in these channels were to be eliminated through a phased program associated with restoration activities. Major studies of the use of shallow water habitats by native and non-native species were to be undertaken to test the assumption that shallow water habitat is indeed the key to restoring many of the native species.

Changes Attributable to ERP

In the Central West Delta EMU, one project titled *Fern-Headreach Tidal Perennial Aquatic and Shaded River Aquatic Conservation Project* (**ERP-98-F16**) acquired a permanent conservation easement for the Fern-Headreach Island Complex on 168 acres along the main channel of the San Joaquin River in the Delta. The 168 acres consisted of 28 acres of shaded riverine aquatic habitat and 140 acres of shallow freshwater tidal perennial aquatic habitat.

The Demonstration Project for the Protection and Enhancement of Delta In-Channel Islands (**ERP-01-N13** and **ERP-97-N11**) installed various biotechnical methods to control erosion and attenuate wave energy adjacent to three eroding in-channel islands (ICI) in the Delta. The protection project treated 0.41 miles of shoreline, and protected a total of 6.24 acres of ICI habitat.

Preliminary results from *Applied Research to Predict Evolution of Restored Diked Wetlands* (**ERP-96-M10**) (Simenstad, C. et al. 2000) provide some intriguing interpretations to the intent and process of restoring delta wetlands by breaching levees:

- The process of rebuilding intertidal elevations, which will be readily colonized by emergent marsh vegetation, cannot be directly extrapolated from what we know about the historical formation of the delta, and it depends greatly on the extent of leveed-island subsidence and the geomorphic region of the delta.
- Native tule marsh vegetation will rapidly colonize emerging intertidal elevations but submerged and floating aquatic vegetation (SAV/FAV), including introduced species such as water hyacinth and *Egeria densa*, will dominate subtidal habitats.
- The occurrence and density of introduced fishes likely will continue to exceed native fishes even with increased levee-breach restoration owing to the extensive area and duration of the subtidal-submerged aquatic vegetation (SAV)/FAV phase of the restoration process and the ability of introduced fishes to exploit these habitats for a greater proportion of the year.
- Maximum invertebrate density typically occurs at the reference site, suggesting the mature site may be more productive; because composition of benthic macroinvertebrate and fallout insect assemblages in breached-dike, shallow-water habitats is generally similar to that for reference sites, breached-dike restoration sites should rapidly contribute to the delta's emergent wetland secondary production.

- Preliminary findings—that emergent marsh and SAV/FAV habitats demonstrate distinct differences in terms of benthic macroinvertebrate and insect contributions—suggest ecological “trade-offs” to restoration strategies that promote large areas and long periods of the subtidal habitat phase of restoration.
- Evidence that food webs supporting both native and introduced fishes derive from SAV/FAV as well as emergent marsh habitats imply that, although SAV/FAV (including exotic species) habitats support prey resources of many fishes, more opportunistic fishes would benefit from early restoration phases, while more restricted habitat/food web specialists will benefit from later stages of predominantly intertidal habitats.

Together these projects, *Fern-Headreach Tidal Perennial Aquatic and Shaded River Aquatic Conservation Project (ERP-98-F16)*, *Demonstration Project for the Protection and Enhancement of Delta In-Channel Islands (ERP-97-N11)*, *Applied Research to Predict Ecological Functions of Evolution of Restored Diked Wetlands (ERP-96-M10)*, and *Phase II: Demonstration Project for the Protection and Enhancement of Delta In-Channel Islands (Construction & Monitoring) (ERP-01-N13)* have met target 1 for one of the four Delta Ecological Management Units.

The Delta In-channel Island Workgroup (2006) made various observations following the completion of the *Phase II: Demonstration Project for the Protection and Enhancement of Delta In-Channel Islands (Construction & Monitoring) (ERP-01-N13)*. The Workgroup found that shorelines of the Delta and in-channel islands are dynamic and exposed to extremely different physical forces dependent on location, exposure, elevation, and substrate. The placement of the designed structures in this demonstration project were functional in reducing erosion and providing habitat, and are environmentally friendly, but are relatively expensive to install and require maintenance. Structure placement provided an increase in native emergent vegetation (planted and volunteer), conservation and protection of productive terrestrial and aquatic habitats that support important fish, wildlife, and plant communities, and protection of islands that provide important buffers to levees from erosive forces. Without this project there would be further loss of habitat and impacts to the resources of the Delta from erosive wave, current, and tidal forces. The demonstration project was a positive model for future projects that deal with preserving and constructing new land/water interfaces specifically in the Delta, and also for other aquatic systems. The structures tested will serve as positive models for future Delta In-channel Island management, levee protection, and tidal wetland protection.

Conceptual models for restoration outcomes along the Bay-Delta estuarine gradient have been created, *Understanding Tidal Marsh Restoration Processes and Patterns: Validating and Extending the "BREACH" Conceptual Model (ERP-99-B13)*. Breach I and II (BREACH) examined trajectories of eleven restoring and nine reference tidal marshes across the salinity gradient from San Pablo Bay to the central Delta. It

collected data on geomorphology, fisheries, invertebrates, vegetation, and birds. Restoration sites had been breached between 1925 and 1995. BREACH learned that interactions between landscape position along estuarine salinity gradients, landscape context, geomorphology, antecedent conditions, and local hydrology may be more important in predicting trajectory than age alone. It learned that certain interactions, such as among vegetation patterns and drainage networks, local sediment sources, and subsidence appear more important than simply predicting a single evolutionary pathway. Importantly, elevation relative to the tidal frame determines whether the site is appropriate for colonization by emergent macrophytes whereas salinity and elevation together determine the nature of the vegetative community. A major distinction is made between those low salinity parts of the estuary, which can be colonized by tules at ~ Mean Lower Low Water (MLLW) and those where bulrush or cordgrass colonize between Mean Tide Level (MTL) and Mean Higher High Water (MHHW). This difference means that non-vegetated intertidal flats are limited in the Delta. Vegetative communities influence the availability of prey for higher trophic levels via primary production, microbial interactions and the provision of habitat for insects. Emergent vegetation provides structure for avifauna including songbirds while SAV supports many exotic fishes. As elevation increases, tidal channel development reflects site antecedent conditions, unvegetated mudflat topography and the interplay between directed flow and patterns of initial vegetation colonization. However, as elevation increases toward MHHW the complexity of the tidal channel network decreases as tidal prism reduces and vegetation encroaches. These conceptual models should improve our basis for restoration planning and provide important guidance to stakeholders, managers and practitioners regarding some expected outcomes of breached levee restoration in the Bay-Delta.

The Integrated Regional Wetland Monitoring (IRWM), a portion funded by *Integrated Regional Wetland Monitoring/Petaluma Marsh Expansion Project (ERP-04-S03)*, is examining how tidal marsh restoration projects are affecting ecological processes at different spatial scales. It is collecting intensive data at six sites covering physical processes, geomorphology, landscape ecology, vegetation, birds, fisheries, invertebrates, food web, primary production, and nutrients. IRWM is building on the BREACH potential with landscape ecology and closely linked vegetation and biota data to help understand these elements better.

The overlap of principal investigators between the projects (BREACH and IRWM) helps to generate unified conceptual models and datasets, with synthetic results interpretation, and in having IRWM build upon lessons learned from BREACH. These nexus of these two projects is now providing new insights into relating tidal marsh restoration progress with their effects on ecological processes and consequently a better understanding of how regional restoration efforts will contribute to species support and recovery (Simenstad and Siegel 2006).

Project Summary Table

Table 1. Midchannel Islands and Shoals Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-C05	Feasibility Study of the Ecosystem and Water Quality Benefits Associated with the Restoration of Franks Tract, Big Break, and Lower Sherman Lake Feasibility study evaluated the potential to create ecosystem, water quality/supply, recreational, and other benefits at Lower Sherman Lake, Big Break, and Franks Tract, by modifying remnant levees to inhibit salt trapping and restoring tidal marsh habitat.	6/30/2005	\$1,218,105	Complete.
ERP-01-N13	Phase II: Demonstration Project for the Protection and Enhancement of Delta In-Channel Islands (Construction & Monitoring) Demonstrated that biotechnical methods can be used in lieu of riprap or other hard surfaces to protect valuable tidal wetlands associated with in-channel islands in the Delta.	9/30/2006	\$1,145,400	Complete. Installed various biotechnical methods to control erosion and attenuate wave energy adjacent to 3 eroding ICI'S (in-channel islands) in the Delta. 2,159 linear feet of shoreline was treated, protecting a total of 6.24 acres of ICI habitat.
ERP-01-N23	Staten Island Acquisition Facilitated acquisition and restoration of the 9,269 acre Staten Island located in the Sacramento-San Joaquin Delta to protect critical agricultural wetlands used by waterfowl and Sandhill cranes. Phase II of this project is ERP-02-P08.	1/31/2006	\$35,110,873	Completed acquisition. Habitats include wildlife friendly agriculture, marsh, riparian, and riverine.
ERP-02D-P54	Restoring Ecosystem Integrity in the Northwest Delta: Phase II Proposes to acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, north Delta tidal channels located west of the Yolo Bypass.	8/31/2008	\$1,781,658	Ongoing, acquisition of conservation easements on 1,100 acres of existing riparian, wetland and/or agricultural lands. Currently in the process of acquiring an agricultural easement on 292 acres.
ERP-02-P21	Restoring Ecosystem Integrity in the Northwest Delta: PHASE II The project's goal is to manage and restore up to 1300 acres of perennial grassland/vernal pool complex in Solano County, CA, and develop a management plan for the Pembco property or other acquisition within the JPP Island Corridor.	8/31/2008	\$246,370	Ongoing, planning, outreach, experimental treatment plots, to determine restoration methods.
ERP-04-S03	Integrated Regional Wetland Monitoring / Petaluma Marsh Expansion Project This project will monitor and evaluate the Petaluma Marsh Expansion Project as a secondary site within the Integrated Regional Wetland Monitoring Project (IRWM).	6/30/2009	\$235,000	Ongoing.

Table 1. Midchannel Islands and Shoals Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-96-M10	Applied Research to Predict Ecological Functions of Evolution of Restored Diked Wetlands Analyzed historically-breached dike wetlands in Delta as a means to predict the feasibility, patterns and rates of restoration to natural function that would be expected from breached-dike restoration strategies.	12/31/1999	\$475,000	Complete.
ERP-97-B02	Monitor and Describe the Movement of Sediment Needed for Habitat Restoration in the Delta and Suisun Bay Described the movement and availability of sediment in the Delta, as needed for habitat restoration.	6/30/2001	\$1,047,010	Complete.
ERP-97-N11	Demonstration Project for the Protection and Enhancement of Delta In-Channel Islands Demonstrated effective biotechnical methods to reduce erosion of in-channel islands and adjacent delta island banks.	5/29/2000	\$270,270	Complete.
ERP-97-N12	Franks Tract State Recreation Area Wetlands Habitat Restoration Conducted planning and preliminary engineering for the restoration of deeply flooded habitat to 45 acres of tidal perennial aquatic, shaded riverine aquatic, and mid channel island shoal and shoal habitats in Frank's Tract State Recreation Area (SRA). Included permitting, environmental compliance, final design and other preconstruction planning.	12/31/2002	\$293,052	Complete.
ERP-98-B34	Discover the Flyway Increased student awareness of wetlands and wildlife issues in the Yolo Basin.	12/31/2001	\$49,000	Completed, enhanced seasonal wetland planting 3,000 native sedge/grass plugs.
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP Implementation of monitoring and applied research that provides data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.
ERP-98-E01	Napa River Watershed Stewardship Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/31/2000	\$250,000	Complete.
ERP-98-F09	Rhode Island Floodplain Management and Habitat Restoration - Phase I Evaluated floodplain and SRA habitat within/adjacent to Rhode Island in the eastern Delta for the purpose of restoring and improve floodplain functions and shallow water and riparian habitat.	6/30/2000	\$25,000	Complete.

Table 1. Midchannel Islands and Shoals Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-F16	Fern-Headreach Tidal Perennial Aquatic and Shaded River Aquatic Conservation Project Acquired permanent conservation easement for Fern-Headreach Island Complex on 168 acres along the main channel of the San Joaquin River in the Delta.	6/30/2000	\$425,000	Completed acquisition of 28 acres of shaded riverine aquatic habitat and 140 acres of shallow freshwater tidal perennial aquatic habitat.
ERP-99-B13	Understanding Tidal Marsh Restoration Processes and Patterns: Validating and Extending the "BREACH" Conceptual Model Addressed considerable uncertainty in predicting the outcome and ecological benefit of restoring shallow water tidal habitat in three different regions of the Bay Delta: the Delta, Suisun Bay, and San Pablo/North Bay.	6/30/2004	\$1,093,292	Completed refinement of conceptual models.
ERP-99-B18	An Evaluation of the Potential Impacts of the Chinese Mitten crab on the Benthic Communities in the Sacramento-San Joaquin Delta and Suisun Bay Provided information regarding the relationship between the Chinese mitten crab (<i>Eriocheir sinensis</i>) and the benthic invertebrate community within the Sacramento-San Joaquin Delta and Suisun Bay.	3/31/2003	\$178,764	Complete.
ERP-99-N11	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Surveyed and mapped the non-native invasive plant species, purple loosestrife. Developed a site specific adaptive management plan and comprehensive local eradication and control efforts.	1/10/2003	\$139,473	Complete.
ERP-99-N11b	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Continued early detection, prevention and eradication/control work for purple loosestrife in the Phase I and Phase II areas (these phases were funded to ERP-99-N11 and ERP-99-F08).	12/31/2005	\$49,865	Complete.

Other Programs Contributing to ERP Vision

DFG created a vegetation classification system for Delta, Suisun Bay, and Suisun Marsh that helps with the monitoring of conservation actions (Hickson and Keeler-Wolf 2007, Keeler-Wolf and Vaghti 2000) completing a portion of the Stage 1 Expectations.

Status of Topic Today

Shallow water habitat is found along midchannel islands and shoals. ERP has conducted major studies of the use of shallow water habitats by native and non-native species to test the assumption that shallow water habitat is indeed the key to restoring many of the native species for expectations for stage 1 strategic objective 2. BREACH and IRWM have produced refined conceptual models for predicting the outcome and ecological benefit of restoring shallow-water tidal habitat in the Bay-Delta. To see a more in-depth discussion regarding the benefits of shallow water habitat in the Delta, see Section 4.3. Delta Sloughs, Status of Topic Today.

To meet stage 1 expectations, ERP needs to develop specific numeric objectives for each habitat type, with restoration objectives based on clearly stated conceptual models. Within and among habitat types, conservation and restoration activities also need to be prioritized. ERP needs to identify channels or channel reaches most suited for restoration and protection of shallow water habitats, as called for by strategic objective 2, stage 1 expectation. Finally, detrimental human activities in these channels also need to be eliminated through a phased program associated with restoration activities.

Planned Projects for Implementation

Feasibility Study of the Ecosystem and Water Quality Benefits Associated with the Restoration of Franks Tract, Big Break, and Lower Sherman Lake (ERP-01-C05) exhaustively explored the options and costs of restoring flooded Delta Islands. The costs of alternatives for restoring small portions of the flooded island varied but were generally greater than 5 million dollars. Most of the alternatives require the intensive use of dredge materials for raising subsided soils to the level at which emergent vegetation can become established. Protection from wind waves would have to be supplied. Uncertainties regarding restoration trajectory and regional impacts remain. DWR is currently exploring pilot project on Franks Tract, based on the recommendations that came out of the final report for this project (the Flooded Island Feasibility Study Report).

Given that detailed baseline and implementation monitoring exists for the Brush box and other soft armoring implemented along Georgianna Slough and Tyler Island, it may be valuable to continue monitoring these sites, or a sampling of them, for some time to determine the long term sustainability of the restoration measures. It would also be worthwhile to examine the cost verses benefit of the use of this low cost biotechnical solutions instead of the type of engineering-intensive, fill-based solutions developed in other ERP studies for channel island and submerged island restoration.

Impediments to Implementation

A major impediment to creation or restoration of midchannel islands and shoals is the subsidence of the Delta. This is particularly true in the central and west Delta where much of the land is severely subsided; some areas are subsided more than 8 meters. The combination of continuing subsidence and rising sea level makes attainment of ERP midchannel islands and shoals targets for the central and west Delta more difficult than originally thought.

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4. HABITATS

4.5. Saline Emergent Wetland

Introduction

Saline emergent wetland habitats are located on the western edge of the Delta and in Suisun Marsh on the Bay. Saline emergent wetland habitats, including brackish and saline wetlands, are important habitats for fish and wildlife that are dependent on marshes and tidal shallows. This designation is similar to the San Francisco Bay Area Wetlands Ecosystem Goals Project (1999) descriptions of tidal marsh which includes tidal salt marsh and tidal brackish marsh.

The loss or degradation of historic saline emergent wetlands has substantially reduced the habitat area available for associated or dependent fish and wildlife species. Several plant and animal species closely associated with tidal saline emergent wetlands have been listed as endangered under the State and federal Endangered Species Acts, primarily as a result of the extensive loss of this habitat type. Major factors that limit this resource's contributions to the health of the Delta are related to harmful effects of saline emergent wetlands conversion for agricultural, industrial, and urban uses.

Applicable ERP Vision

The vision is to increase the area and protect the quality of existing saline emergent wetlands from degradation or loss to assist in the recovery of special-status plant, fish, and wildlife populations.

Stage 1 Expectations

The Stage 1 Expectation was that ongoing efforts to restore large expanses of tidal marsh continue and experimental pilot projects to restore tidal marshes to areas in the Suisun Marsh and San Pablo Bay are undertaken.

Changes Attributable to ERP

As a direct result of ERP activities along the Petaluma River Estuary a combined 865 acres of upland and marsh elevation lands were preserved. Of that total, 109 acres along the Petaluma River were hydraulically reconnected with full tidal exchange. An estimated 200 acres were reconnected to provide muted tidal exchange in Bahia (*Bahia*

Acquisition and Tidal Wetland Restoration (ERP-02-P14). As the Bahia restoration matures there is potential for another 130 acres of tidal marsh. The resulting total, 439 acres, would be just short of the target of 500 acres minimum for the Petaluma River Management Unit.

In the Napa River Management Unit there have been acquisitions totaling 12,100 acres of which ERP contributed funding for 595 acres. Approximately 9,850 of former salt ponds have been acquired since the initial Stage 1 implementation planning. ERP funds were instrumental in restoring tidal circulation to 3,595 acres of formerly diked baylands in the estuarine reach of the Napa River. Therefore, the 1,000 - 2,000 acres of Saline Emergent Wetland target has been met and exceeded.

Due to acquisitions completed in the Sonoma Creek Management Unit prior to Stage 1 planning, land sufficient to meet the goal of 1,000 acres of tidal marsh restoration is already available. The restoration on Tolay Creek, funded by the *Tolay Creek Restoration Project (ERP-97-N19)*, resulted in the preservation of 431 acres of tidal wetlands, 123 acres of which were newly restored. An additional 1,100 acres of lands banked by DFG (Wingo Unit) and the Sonoma Land Trust (Sonoma Baylands) contain potential tidal restoration acreage sufficient to meet the stage 1 target of 500-1,000 acres although much of this area is currently dedicated to remain diked, managed, perennial aquatic habitat.

Plans call for the restoration of approximately 1,000 acres of bayfront tidal wetlands at Hamilton and 1,200 acres of tidal wetlands at Bel Marin Keyes. The restorations will include expanding tidal prism in the Novato Creek floodplain. These tidal marsh restoration activities will take 30 years to implement and require the construction of over four miles of levees for flood and resource protection. Upon completion, the project will have met the Stage 1 implementation target to restore 500-1,000 acres of tidal marsh.

With the help of the ERP, acquisition of tidal marsh for the San Pablo Bay region over the last several years has provided the potential to meet ERP acreage objectives for saline emergent wetlands through subsequent preservation, enhancement and restoration projects. Progress towards meeting ERP Saline Emergent habitat targets depends upon factors including elevation, sediment availability and local hydrology. Marsh evolution following tidal restoration will typically progress from an open water condition to intermediate open water and emergent vegetation, then to a new equilibrium of open water and saline marsh. In some respects it might be more accurate to report that, at this time, a significant portion of the saline tidal restoration activities are meeting the open water goals but not the saline marsh targets.

It is hypothesized that primary productivity in the Delta will increase as a result of tidal restoration associated with meeting saline emergent habitat acreage objectives. Regional patterns of salinity and tidal exchange may also respond to the increased tidal

prism in the western end of the Bay Delta Estuary. Scalar transport models indicate the possibility that X2 may migrate westward as a result of the tidal marsh restorations in the North Bay and Suisun Bay regions. Mercury mobilization and transformation may also occur. The extent to which these changes may alter the food web and hydrodynamics in the Delta and South Bay, where restoration of an additional 15,000 acres is underway, is also unknown.

The goal for saline (brackish) emergent wetland habitat in Suisun Marsh and Bay EMU is 5,000 to 7,000 acres of full tidal restoration. To the extent that the pending Suisun Marsh Plan results in implementation of the strategies in *Update Individual Ownership Adaptive Management Habitat Plans (ERP-02-P23)* for enhancing potential saline emergent habitat among the approximately 53,000 privately held acres of managed marsh, a significant amount of saline emergent wetland can result. These enhanced managed wetlands will need to be monitored to determine whether functionality of the created habitat contributes to ERP biodiversity and at risk species goals.

Three site specific restoration planning projects in the Suisun Bay Region received ERP funds during Stage 1. *Hill Slough West Habitat Restoration Demonstration Project (ERP-01-C09)* produced a plan for what was originally planned to be restoration of a 207-acre diked wetland in the northern Suisun Marsh just south of Highway 12 and west of Grizzly Island Road in Suisun City. Subsequent developments have enlarged the scope such that a new plan for an expanded project to include land, also owned by the DFG, to the east of the Grizzly Island Road. This 800-acre site will provide a buffer between the Marsh and the development occurring directly to the north.

The greatest strides in making progress towards meeting the Stage 1 habitat acreage targets for saline emergent wetland in Suisun Marsh are expected to follow from the comprehensive planning efforts conducted under *Suisun Marsh Implementation Plan (Center for Collaborative Policy) (ERP-04D-S21)*, and *Suisun Marsh Implementation Plan (ERP-05D-C02)*. The planning process is being conducted under the umbrella of the Suisun Marsh Charter Group that includes private property owners and habitat and water project agencies. These projects fund participation in plan scoping and the consultant supported preparation of the programmatic environmental and planning documents.

The charter entities recognized that early difficulties in reaching a consensus on plan elements would not be resolved without facilitation. The planning process has made significant headway since enlisting the services of a professional facilitation team under the ERP funded project *Suisun Marsh Implementation Plan (Jones & Stokes) (ERP-04D-S20)*.

Project Summary Table

Table 1. Saline Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-C01	Invasive <i>Spartina</i> Project Expanded effort to plan and implement control measures for <i>Spartina alterniflora</i> , contribute to the overall scientific understanding of the species, and build a bay-wide infrastructure to detect and prevent its future invasions.	10/31/2006	\$1,793,661	Complete.
ERP-01-C04	Suisun Marsh Property Acquisition & Habitat Restoration Acquired property in the Suisun Marsh, along Hill Slough, restored to a fully functioning self-sustaining tidal wetland ecosystem which includes low-marsh, high-marsh, and upland transition zones, increasing the area and contiguity of saline emergent wetlands thereby assisting in the recovery of at-risk species.	6/30/2006	\$536,750	Complete. Acquired Blacklock parcel (69 acres).
ERP-01-C09	Hill Slough West Habitat Restoration Demonstration Project, Phase II Completed the environmental documentation and permitting for a multi-phased project to restore tidal action to seasonal and permanent wetlands in the Suisun Marsh.	11/30/2006	\$87,000	Complete.
ERP-01-N19	Ecological Monitoring of Tolay & Cullinan Ranch Tidal Wetlands Restoration Monitored the Tolay Creek (ERP-97-N19) and Cullinan Ranch (ERP-97-N18) Tidal Wetland Restoration Projects in the North San Francisco Bay.	6/30/2006	\$593,931	Complete.
ERP-02D-P62	Mercury and Methylmercury Processes in North San Francisco Bay Tidal Wetland Ecosystems Investigates mercury cycling in tidal wetlands of the Petaluma river, with emphasis on quantifying and understanding processes that influence the abundance of methylmercury.	5/14/2008	\$1,941,293	Ongoing.
ERP-02D-P71	Napa-Sonoma Marsh Restoration Project - Construction Phase (Ponds 3,4, and 5) Phase I of the Napa-Sonoma Marsh restoration project, a Federal USACE project which entails the restoration of three former commercial salt ponds along the Napa River, totaling approximately 3,000 acres.	6/30/2007	\$3,203,000	Complete. Restored Pond 3 (1,300 ac) to tidal marsh and associated marsh habitat by lowering, grading, and breaching levees. Breach levees on ponds 4 and 5 (combined 1,700 ac) for salinity reduction in preparation for restoration.

Table 1. Saline Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P04-D	Napa-Sonoma Marsh Restoration Project Restoration of three former commercial salt ponds along the Napa River, totaling approximately 3,000 acres, to tidal marsh. It is a phase of the Napa-Sonoma Marsh restoration project, a Federal USACE project. Restoration of Ponds 3, 4, and 5, which includes construction of approximately two water control structures or levee breaches for salinity reduction; and levee breaches, ditch blocks, levee lowering, starter channels, and berms for habitat restoration.	11/7/2006	\$1,339,000	Complete. Would have had some restoration measures, but according to the last two quarterly reports, task 5 (Construction) has been deleted from the project by amendment # 1 to ERP-02-P04D (S-02-RA-017) and handed over to the Wildlife Conservation Board.
ERP-02-P14	Bahia Acquisition and Tidal Wetland Restoration Will acquire the 631 acre Bahia site, which consists of historic tidal wetlands and adjacent uplands, and the restoration of the former wetlands to tidal marsh by developing a plan to restore 330 acres of currently diked wetlands to tidal action and implementing that plan.	6/1/2009	\$3,345,000	Ongoing.
ERP-02-P19	Determining the Mechanisms Relating Freshwater Flow and Abundance of Estuarine Biota (the "Fish-X2" relationships) Phase I Phase I of a research program. The ultimate purpose of this project is to contribute to the understanding of the factors that control the distribution and abundance of estuarine species, how these factors vary with X2, and how they might change in the future.	6/30/2007	\$509,222	Complete.
ERP-02-P23	Update Individual Ownership Adaptive Management Habitat Plans Updated 140 "Individual Ownership Management Plans for Private Properties" within the Suisun Marsh and provided wetland management educational information for private landowners.	6/30//2007	\$214,943	Complete.
ERP-04D-S20	Suisun Marsh Implementation Plan (Jones & Stokes) This project will prepare draft and final programmatic regional implementation planning documents for the Suisun Marsh Plan.	6/30/2008	\$1,490,500	Ongoing.
ERP-04D-S21	Suisun Marsh Implementation Plan (Center for Collaborative Policy) This project will provide the facilitation and collaboration assistance supporting the preparation of regional implementation plans in the Suisun Marsh.	6/30/2008	\$200,000	Ongoing.

Table 1. Saline Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-04-S02	Monitoring for Invasive <i>Spartina</i> Control in the San Francisco Estuary Provides timely, high quality data regarding the location and extent of invasive <i>Spartina</i> to the San Francisco Estuary Invasive <i>Spartina</i> Project, so that it may plan and rapidly implement cost-effective weed control measures and determine when site-specific and regional control objectives have been met. In addition, the Monitoring Program will provide accurate data on the status of endangered California clapper rails at the <i>Spartina</i> treatment sites, to allow <i>Spartina</i> control to be implemented with minimum adverse effects on rails.	12/31/2008	\$1,234,396	Ongoing.
ERP-05D-C02	Suisun Marsh Implementation Plan The primary objective of this project is to complete all the activities supporting the preparation of regional implementation plans in the Suisun Marsh.	6/30/2006	\$110,000	Complete
ERP-95-M07	Suisun Marsh Fish Screen Project Phase 1 (diversion evaluation and selection) of a larger program to construct fish screens on 5 diversions in the Suisun Marsh to reduce downstream migrant salmonid mortality and mortality of delta smelt and splittail.	12/31/1996	\$450,000	Complete. Installed fish screens on intake gate along Montezuma Slough, intake gates at Clubs 425, 426, 502, 506, and 634.
ERP-97-B02	Monitor and Describe the Movement of Sediment Needed for Habitat Restoration in the Delta and Suisun Bay Described the movement and availability of sediment in the Delta, as needed for habitat restoration.	6/30/2001	\$1,047,010	Complete.
ERP-97-C07	Preventing Exotic Introductions from Ballast Water Increased maritime industry members' awareness of ballast water release issues and alternative practices in order to reduce the introduction of nonnative species into the Delta.	8/31/2001	\$222,830	Complete.
ERP-97-N16	Bay Point Shoreline Restoration Plan Developed a restoration plan for the Bay Point Regional Shoreline aimed at restoring tidal salt marsh habitat and ecosystem function.	10/31/2001	\$185,000	Complete. Phase I is for hiring a consultant to develop a restoration plan for the shoreline.
ERP-97-N18	Cullinan Ranch Restoration Part 1 of a larger effort, aims at restoring tidal salt marsh habitat and ecosystem function in Cullinan Ranch. Prepared environmental permits and design engineering plans to restore 1,495 acres of saline emergent wetland habitat by supplying the necessary sediments through accretion to restore proper tidal elevation gradients at the project site.	6/17/2004	\$368,500	Complete. Planning, due to unexpected analysis, coordination and design of the Cullinan Ranch Tidal Restoration Project, construction activities could not be initiated during the grant period.
ERP-97-N19	Tolay Creek Restoration Project Restored and enhanced 435 acres of saline emergent wetlands in the Tolay Creek floodplain for the benefit of threatened and endangered species.	9/17/2001	\$283,000	Complete.

Table 1. Saline Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-B09	Integrated Pest Management Partnership to Improve Water Quality in Suisun Bay and Local Creeks Increased awareness of users of detrimental impacts of the use and disposal of pesticides and provide education and outreach of integrated pest management (IPM) to improve water quality in the Suisun Bay and local creeks.	10/31/2001	\$273,276	Complete.
ERP-98-B13	South Napa River Wetlands Acquisition Addressed considerable uncertainty in predicting the outcome and ecological benefit of restoring shallow-water tidal habitat in three different regions of the Bay Delta: the Delta, Suisun Bay, and San Pablo/North Bay.	9/30/2000	\$1,073,513	Complete. Acquired and restored 68 acres. Habitats: seasonal, connected wetland, riparian and riverine aquatic - riparian & instream, saline emergent wetlands.
ERP-98-C03	Hamilton Wetlands Restoration Planning Planning and environmental documentation for the restoration of 2,500 acres of subsided, diked baylands to a mix of seasonal and tidal wetlands.	6/30/2002	\$1,070,030	Complete.
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP Implementation of monitoring and applied research that provides data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.
ERP-98-E01	Napa River Watershed Stewardship Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/31/2000	\$250,000	Complete.
ERP-98-E03	San Francisco Bay Area Wetlands Ecosystem Goals Project Enabled the collection of data to be use in the creation of habitat goals which will be used by private, local, state, and federal entities seeking to protect and improve the San Francisco Bay Area's wetlands.	3/31/1998	\$76,000	Complete.

Table 1. Saline Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-E04	Petaluma River Watershed Restoration Program Provided funds to implement the restoration and monitoring projects identified in the Petaluma River Watershed Enhancement Plan with the goal of enhancing and restoring habitat and ecosystem function along the Petaluma River.	2/28/2001	\$220,000	Complete. Willowbrook/ Lichau Creek reduced habitat fragmentation by reestablishing riparian vegetation along 3,000ft of stream. San Antonio Creek stabilized 1,000ft of streambank and planting native vegetation along 2,000ft of streambank. Habitat restored: saline emergent wetlands, riparian and riverine aquatic – in-stream (0.76 miles total).
ERP-98-E17	Alhambra Creek Watershed CRMP Program Developed a watershed management plan for the Alhambra Creek Watershed Plan using the Coordinated Resource Management Planning (CRMP) process. Also completed a Quality Assurance Project Plan (QAPP); A Users Manual; and Established Watershed Planning Group for public outreach.	4/30/2001	\$138,500	Complete.
ERP-98-F08	Hill Slough West Habitat Restoration Demonstration Project Completed the topographic surveys, hydrological evaluation, conceptual restoration plan, and monitoring plan for a multi-phased project to restore tidal action to seasonal and permanent wetlands in the Suisun Marsh at Hill Slough.	5/30/2002	\$200,000	Complete.
ERP-98-F13	Petaluma Marsh Expansion Project - Marin County Preserved a total of 181.46 acres of baylands west of the Petaluma River at the Marin-Sonoma County border by restoring and permanently protecting land for the benefit of several important species as part of the Petaluma Marsh, the largest undiked tidal marsh remaining in the Bay.	3/31/2004	\$503,635	Complete. Acquired 181.46 acres of baylands, restored 109.72 acres to saline emergent wetland.
ERP-98-F17	Benicia Waterfront Marsh Restoration Project Phase 1, final planning and permitting for the restoration of 8 acres of degraded salt marsh habitat along the Benicia waterfront in downtown Benicia for the benefit of several important plant and animal species.	2/28/2001	\$59,000	Complete.

Table 1. Saline Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-F22	Biological Restoration and Monitoring in the Suisun Marsh/North San Francisco Bay Ecological Zone: An Ecosystem Approach to Improved Effectiveness of Bay/Delta Restoration Restored, maintained, and monitored two restoration projects (totaling 272 acres) in eastern San Pablo Bay and southern Suisun Bay with the objectives to restore emergent and immersed marshland, monitor the restored ecosystems, and improve restoration successes.	9/30/2001	\$772,667	Complete. Two sites (totaling 272 acres: Tubbs 72 acres, Shell Marsh 200 acres). Habitats include: tidal perennial freshwater, saltwater tidal, instream aquatic and shaded riverine aquatic.
ERP-98-F23	South Napa River Tidal Slough and Floodplain Restoration Project First phase in restoring over 460 acres of wetlands in the South Napa River Tidal Slough. Funded acquisition of the property, preliminary design work, an environmental feasibility study, and environmental compliance document.	6/30/2001	\$1,480,000	Complete. Acquired 453.24 acres. Habitats include: tidal perennial aquatic, saline emergent wetland, sloughs, seasonal wetlands, and perennial grasses.
ERP-99-B10	Species and Community Profiles Report of the San Francisco Bay Area Wetlands Ecosystem Goals Project Funded the completion of the Species and Community Profiles Report as part of the Goals Project to provide information on over 97 species of plants and animals providing scientific information on species needs, distribution, life history, and population trends.	9/30/2001	\$30,614	Complete.
ERP-99-B11	South Napa River Tidal Slough and Floodplain Restoration Project Phase 2 of the South Napa River Tidal Slough and Floodplain Restoration Project, which involved the restoration of tidal flow to 2.3 miles of historic slough habitat, and the restoration of nearly 483 acres of wetlands and uplands.	9/30/2005	\$1,520,000	Complete. Original and new habitats: perennial grasslands, saline emergent wetland, tidal perennial aquatic, tidal sloughs and seasonal wetlands.
ERP-99-B13	Understanding Tidal Marsh Restoration Processes and Patterns: Validating and Extending the "BREACH" Conceptual Model Addressed considerable uncertainty in predicting the outcome and ecological benefit of restoring shallow-water tidal habitat in three different regions of the Bay Delta: the Delta, Suisun Bay, and San Pablo/North Bay.	6/30/2004	\$1,093,292	Complete. Refinement of conceptual models.
ERP-99-B26	1999/2000 Bay-Delta Education Program Increased the public's awareness and understanding of the issues affecting the Bay-Delta, and make it feasible for members of the public to support CALFED while altering their behavior to be a part of environmental solutions.	11/30/2000	\$32,300.00	Complete.

Table 1. Saline Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-N05	Reintroduction of Endangered Soft Birds Beak to Restored Habitat in Suisun Marsh. Provided critical ecological data to facilitate rare plant restoration; soft birds beak (<i>Cordylanthus mollis</i> sp. <i>mollis</i>); as a contribution towards CALFED objectives for improved ecosystem quality through native species recovery and conservation.	12/31/2002	\$178,889	Complete.
ERP-99-N11	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Surveyed and mapped the non-native invasive plant species, purple loosestrife. This project developed a site specific adaptive management plan and comprehensive local eradication and control efforts.	1/10/2003	\$139,473	Complete.
ERP-99-N11b	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Continued early detection, prevention and eradication/control work for purple loosestrife in the Phase I and Phase II areas (these phases were funded to ERP-99-N11 and ERP-99-F08).	12/31/2003	\$49,865	Complete.

Other Programs Contributing to ERP Vision

The State Coastal Conservancy and local land trusts have also been funding acquisitions for ultimate restoration of tidal marsh. The Sonoma Land Trust is very active in the San Pablo Bay region and well supported. Extensive areas of marsh and uplands have been acquired within the last five years. Conservation entities, including the San Francisco Bay Joint Venture, are very actively implementing acquisition, preservation and restoration strategies in this unit.

The various agencies and Districts that constitute the Suisun Marsh Charter Group have contributed generously to the planning efforts that have brought the Suisun Marsh Plan to within two years of completion.

Status of Topic Today

The tidal restoration and preservation efforts to date will require more time to reach maturity. Follow up monitoring for habitat change and functionality is advisable. Many of these areas are not scheduled for restoration in the near future. Limited availability of funding will likely continue to delay restoration.

A suite of modeling tools being developed for the North Delta by an upcoming ERP project *BREACH III: Evaluating and Predicting 'Restoration Thresholds' in Evolving Freshwater-Tidal Marshes* (**ERP-04D-S18**) may, with modifications, be of considerable value in developing restoration planning scenarios in the Saline Emergent habitat types west of the Central Delta. Many portions of Cullinan Ranch and the Suisun Marsh, while already in public ownership, are not at optimal elevations for emergent wetland colonization. Limited sediment supply may be available. Modeling may be able to identify restoration opportunities that are presently not recognized.

The Suisun Marsh Plan is being developed with two key assurances for landowners in the Marsh, that the recent moratorium on dredging of local channels will be lifted and that land for tidal marsh restoration will only be acquired from willing sellers. There is also an assumption that fresh water supplies will continue uninterrupted for the purpose of lowering salinity on managed wetlands. These assurances and assumptions are consistent with the CALFED goals of reducing conflict and preserving all beneficial uses. The continued preservation of all historic beneficial uses is also consistent with the considerable investments in infrastructure that have been made to continue supplying fresh water to the Marsh during the period when it was naturally the most brackish. However, balancing the ecosystem needs while maintaining these assurances and investments will pose a considerable challenge both ecologically and financially.

If a peripheral canal is approved, the Delta will likely be managed to mimic original salinity and flow patterns. In that scenario, the operational and environmental cost of maintaining a "fresh" Suisun Marsh in the fall may not have the political support it once had. The logistics of balancing conflicting or seemingly incompatible uses may change if an isolated facility for water exports is approved by voters in the next elections. The ERPP planning documents will also need to be completely redrafted.

In Suisun, it appears that tidal marsh restoration and channel dredging for levee maintenance may compete for the same sediment supply. Tidal Marsh restoration will be limited unless sediment is available for raising tidal marsh plains to elevations capable of supporting emergent vegetation. With local sediment in such demand, there is potential to disturb fish habitat. Mercury mobilization and methylation is a potential outcome of both managed wetland operations and restoration as well. In order to determine how restoration and managed wetland operations can proceed in tandem without deleterious impacts, ongoing monitoring for restoration planning and adaptive management in the Marsh should be supported.

Acquisition of adjacent uplands may be important for assuring that sufficient potential habitat exists for saline emergent wetlands in the event that sea level rise occurs at presently predicted rates (3 feet of rise in this century).

Planned Projects for Implementation

Two Stage 1 planning projects were conducted for the City of Benicia and for East Bay Regional Parks District for sites near the disadvantaged unincorporated community of Bay Pointe, in Contra Costa County. What is notable about both of these projects is that the plans have been completed for some time but the proponents were unable to secure subsequent funding for implementation. A total of 43 acres of saline emergent wetland could be restored if funding were made available. Representatives for both projects indicate that plans remain valid and, except for funding the projects are ready to go. Matching fund sources have been identified in both cases.

In the North Bay Region acquisition of land on Tubbs Island and Tolay Creek would improve habitat connectivity with and management of the existing DFG wetland complex in the Sonoma Creek area. Opportunities to acquire additional saline emergent and other adjoining habitat types in these areas would enhance the ERP acreage targets while meeting DFG Bay Delta Region management and habitat enhancement concerns. Worth noting as well is the existence of a single wetland that contains the only known occurrences of vernal pool fairy shrimp in Napa County, near the Napa marsh complex.

In the area just to the north of the Suisun Marsh are thousands of acres of potential saline emergent and adjacent habitat types. Much of this wetland bearing acreage has been lost to development through missed opportunities to engage the local government in habitat conservation planning. Those developments will require costly flood protection infrastructure if sea levels rise at the rates predicted within this century.

ERP should be poised to act if opportunities to protect existing and potential wetlands that are not included in the primary and secondary Suisun marsh protection zones become available. The land referred to as the Gentry Project just south of Highway 12 in Fairfield contains 23 acres of seasonal wetlands and a reach of Ledgewood Creek. The area is within the salinity gradient of the marsh but Contra Costa goldfields occur in the upper reaches. In a parcel just across the road, Burrowing Owl and Suisun Marsh harvest mouse occur on “developable” land that is not protected. There have been indications that some frequently flooded lands in the area of Chadbourne Road may be available for acquisition. Although large portions of these lands are highly subsided and not the best candidates for saline emergent marsh, they are in the vicinity of Suisun Valley Creek, a potential source of sediment. Reconnection of Green Valley and Suisun Valley Creeks to historic floodplains in the reaches that transition to the marsh is an exciting restoration opportunity that has not received the attention of the Suisun Marsh Plan process due to that forum’s focus on managed wetlands. There is preliminary evidence (Rodriguez 2008 pers comm) that vegetated sand splays and associated emergent wetlands, similar to those described on the tidal reaches of the Cosumnes by Mount and Florsheim (2003), were an historic feature of the reaches of these streams that transition to the marsh.

Impediments to Implementation

Some of the acreage acquired for restoration in the San Pablo Bay Region has subsided below levels that make passive or minor construction restoration strategies feasible. In addition, the position of Highway 37 in the landscape is a major impediment to reconnection of diked baylands to San Pablo Bay, the historic tidal connection.

Identifying willing sellers of potential emergent wetland habitat lands in Suisun Marsh has, to date, proven difficult.

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4. HABITATS

4.6. Freshwater Emergent Wetland

Introduction

Most freshwater emergent wetlands in the Delta occur as narrow, fragmented bands. These fragmented wetlands appear along island levees, channel islands, shorelines and levee blowout ponds. Small areas of nontidal fresh emergent wetlands exist on Delta islands. These Delta island wetlands are primarily associated with agricultural infrastructure (e.g. drainage ditches), levee blowout ponds, and areas managed for wetlands (e.g. duck clubs). Fresh emergent wetlands also include natural non-tidal wetlands outside of the Delta and are found throughout the ERP focus area.

Tidal and nontidal fresh emergent wetland habitats are important habitat areas for fish and wildlife dependent on marshes and tidal shallows and support several special-status plant species. The loss or degradation of historic fresh emergent wetlands has substantially reduced the habitat area available for associated fish and wildlife species. Major factors that limit this resource's contribution to the health of the Bay-Delta are related to the adverse effects of wetlands conversion to agricultural, industrial, and urban uses.

Applicable ERP Vision

The vision is to increase the area and improve the quality of existing freshwater emergent wetlands from degradation or loss and increase wetland habitat to assist in the recovery of special-status plant, fish, and wildlife populations, and provide high-quality habitat for other fish and wildlife dependent on the Bay-Delta.

Stage 1 Expectations

Stage 1 expectations include development of a classification system for Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay habitats that can be used as a basis for conservation actions. Specific, numeric objectives were to be formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. Within and among habitat types, conservation and restoration activities were to be prioritized. Work was to begin on those projects given highest priority within a year of adoption of the strategic plan.

Changes Attributable to ERP

ERP funded projects have restored unspecified amount of fresh emergent wetland on 5,209 acres of land, and there are additional projects involving 21,162 acres of land which will restore a yet to be determined amount of fresh emergent wetland (Table 1). Liberty Island, which is 5,209 acres, is being passively restored to various habitats including tidal fresh emergent wetland habitat (*Liberty Island Acquisition* (**ERP-00-F06** and **ERP-97-B03**). A recent vegetation classification project which covered the Delta, including Liberty Island, document 740 acres of fresh emergent wetland (Hickson and Keeler-Wolf 2007). Also see Changes Attributable to ERP in Section 4.3 Delta Sloughs for information on habitat on Liberty Islands. *Stone Lakes NWR Land Acquisition* (**ERP-98-F12**) and the Cosumnes River Preserve (*Cosumnes Start-up Stewardship and Restoration* (**ERP-97-N14**) restored fresh emergent wetland; unfortunately the amount has not be documented.

Dutch Slough Tidal Marsh Restoration Project (Phase I) (**ERP-02-C07-D**), which covers 1,166 acres, estimates that it may restore up to 483 acres of fresh emergent wetland (identified in proposal as nontidal emergent wetland and intertidal marsh).

Understanding Tidal Marsh Restoration Processes and Patterns: Validating and Extending the "BREACH" Conceptual Model (**ERP-99-B13**) found that fish species assemblages increasingly resemble reference site assemblages in restored marshes approaching eight years maturity. The fish species assemblage trends in mature restored marshes were towards increasing percentages of native fish species.

Project Summary Table

Table 1. Fresh Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-F06	Liberty Island Acquisition Acquired fee title interest in the remaining two privately-owned properties on Liberty Island, estimated at 449 acres; and to conduct restoration of tidal shallow water habitat, tidal emergent wetlands, and seasonal wetlands for aquatic and terrestrial species.	9/30/2007	\$2,625,153	Complete.
ERP-00-F08	McCormack-Williamson Tract Restoration Planning, Design and Monitoring Program I Performed baseline studies necessary for project planning and design, and the development of long-term monitoring programs of the McCormack-Williamson Tract, which is a 1,600-acre Delta island.	8/1/2003	\$556,200	Complete, research and planning for 1,512 acres of agricultural land.

Table 1. Fresh Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-C05	Feasibility Study of the Ecosystem and Water Quality Benefits Associated with the Restoration of Franks Tract, Big Break, and Lower Sherman Lake Evaluated the potential to create ecosystem, water quality/supply, recreational, and other benefits at Lower Sherman Lake, Big Break, and Franks Tract, by modifying remnant levees to inhibit salt trapping and restoring tidal marsh	6/30/2005	\$1,218,105	Complete.
ERP-01-N23	Staten Island Acquisition Facilitated acquisition and restoration of the 9,106 acre Staten Island located in the Sacramento-San Joaquin Delta to protect critical agricultural wetlands used by waterfowl and Sandhill cranes. Phase II of this project is ERP-02-P08.	1/31/2006	\$35,110,873	Complete. Habitats include wildlife friendly agriculture, marsh, riparian, and riverine.
ERP-01-N30	Digital Soil Survey Mapping and Digital Orthophotoquad Imagery Development Made soils information more accessible to individuals and groups engaged in ecosystem restoration projects in the Bay-Delta Region, and in doing so, improved the responsiveness of these projects to establishing habitat and supporting sustainable populations of valuable species.	8/15/2004	\$430,390	Complete.
ERP-01-N38	Delta Studies Program: San Joaquin County Schools Increased student and teacher knowledge at sixty targeted schools in San Joaquin County. The program developed a Delta Studies Curriculum, developed and maintained a Delta Education Resource Center, and recruited, identified, trained, and supported a cadre of thirty teacher leaders each, per years Two and Three. Called Delta Educational Leaders for Teaching and Action (DELTA).	6/30/2004	\$323,198	Complete.
ERP-02-C07-D	Dutch Slough Tidal Marsh Restoration Project (Phase I) Acquired the three contiguous parcels totaling 1,166 acres that comprise the Dutch Slough site.	12/31/2006	\$23,550,000	Complete.
ERP-02D-P52	Big Break and Marsh Creek Water Quality and Habitat Restoration Program Developed a public outreach and education program in the Marsh Creek watershed.	10/15/2007	\$402,600	Complete.
ERP-02D-P54	Restoring Ecosystem Integrity in the Northwest Delta: Phase II This project proposes to acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, north Delta tidal channels located west of the Yolo Bypass.	8/31/2008	\$1,781,658	Ongoing acquisition of conservation easements on 1,100 acres of existing riparian, wetland and/or agricultural lands. Currently in the process of acquiring an agricultural easement on 292 acres.

Table 1. Fresh Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P03-D	Dutch Slough Restoration Project Developed a restoration plan for a 1,166 acre site adjacent to Dutch Slough and the mouth of Marsh Creek in the western Delta.	11/2/2008	\$1,500,000	Ongoing.
ERP-02-P12	Sustainable Restoration Technologies for Bay/Delta Tidal Marsh and Riparian Habitat Protected natural embankment and reconstructed, through passive recruitment of new sediment, new riparian and shaded riverine aquatic habitat in aquatic channels.	12/30/2006	\$1,800,000	Complete. 3.72 river miles (1.99 miles in East Delta, 0.5 miles in North Delta, 0.81 miles in Central and West Delta, 0.42 miles in the Suisun Marsh and Bay) of restored riverbank, levee and shoreline tidal environments to riparian and marsh habitats.
ERP-02-P19	Determining the Mechanisms Relating Freshwater Flow and Abundance of Estuarine Biota (the "Fish-X2" relationships) Phase I Phase I of a research program. The ultimate purpose was to contribute to the understanding of the factors that control the distribution and abundance of estuarine species, how these factors vary with X2, and how they might change in the future.	6/30/2007	\$509,222	Complete.
ERP-05-S27	Rice-Cover Crop Rotation Pilot Program Implements a 3-year pilot project to benefit ground nesting birds, giant garter snakes, and other wetland dependent species through altered crop rotations and semi-permanent wetlands.	2/1/2011	\$1,649,051	Ongoing. ~1,000 acres of wildlife friendly agriculture (Butte Basin EMZ).
ERP-05-S28	American Basin Working Landscapes Project Will develop a GIS-based "working landscapes" model/plan for the American basin. Also, implements voluntary practices where appropriate, including easements, riparian restoration, wetland restoration, other on-farm, and farm-edge habitat restoration practices.	6/30/2010	\$1,860,898	Ongoing. ~400 acres of wildlife friendly agriculture. Restore 28 acres of riparian vegetation and riverine corridors and 28 acres – natural wetland systems.
ERP-96-M10	Applied Research to Predict Ecological Functions of Evolution of Restored Diked Wetlands Analyzed historically-breached dike wetlands in Delta as a means to predict the feasibility, patterns and rates of restoration to natural function that would be expected from breached-dike restoration strategies.	12/31/1999	\$475,000	Complete.
ERP-97-B02	Monitor and Describe the Movement of Sediment Needed for Habitat Restoration in the Delta and Suisun Bay Described the movement and availability of sediment in the Delta, as needed for habitat restoration.	6/30/2001	\$1,047,010	Complete.
ERP-97-B03	Liberty Island Acquisition Protected and restored tidally influenced wetlands, riparian corridors, and upland habitats on Liberty Island in the Yolo Bypass.	9/30/2003	\$8,926,000	Completed acquisition of 4,760 acres of Liberty Island.

Table 1. Fresh Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-N10	Restoring Ecosystem Integrity in the Northwestern Delta - Jepson Prairie Restoration and Habitat Conservation Plan Restored habitat along two northwest Delta sloughs and adjacent perennial grasslands at Jepson Prairie.	9/30/2002	\$292,801	Complete. Converted 507 acres of agricultural grazing land to perennial grassland. Fenced 500 ft along the bank of Calhoun Cut and planted native plants to restore riparian and enhancing Delta Sloughs.
ERP-97-N11	Demonstration Project for the Protection and Enhancement of Delta In-Channel Islands Demonstration Project for the Protection and Enhancement of Delta In-Channel Islands.	3/29/2000	\$270,270	Complete.
ERP-97-N14	Cosumnes Start-up Stewardship and Restoration Acquisition and planning for 2,341 acres of floodplain properties consisting of various habitat types (agricultural land, dairy, oak woodland, grasslands, seasonal wetlands). Includes clean-up and repair of the properties.	9/30/2002	\$2,305,730	Complete.
ERP-98-B17	Cosumnes Floodplain Acquisition and Restoration Restored and improved floodplain functions. Restored riparian and wetland vegetation.	12/31/1998	\$3,500,000	Complete.
ERP-98-B34	Discover the Flyway Increased student awareness of wetlands and wildlife issues in the Yolo Basin.	12/31/2001	\$49,000	Complete, enhanced seasonal wetland planting 3,000 native sedge/grass plugs.
ERP-98-C01	Demonstration of Techniques for Reversing the Effects of Subsidence in the Sacramento-San Joaquin Delta: Phase 1 - Twitchell Island Evaluated techniques to reverse the subsidence of Delta islands.	12/31/2006	\$3,886,995	Complete.
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP Implementation of monitoring and applied research that provides data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.
ERP-98-C17	Assist in Developing Appraisal & Planning with TNC for the McCormack-Williamson Property The California Department of Water Resources provided services and support for the acquisition and initial site planning for the McCormack-Williamson Tract, including an appraisal, a legal transaction review, and initial planning activities.	11/30/2001	\$24,000	Complete.
ERP-98-E01	Napa River Watershed Stewardship Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/31/2000	\$250,000	Complete.

Table 1. Fresh Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-F12	Stone Lakes NWR Land Acquisition Acquired fee title to approximately 537.35 acres of land within the boundary of the Stone Lakes National Wildlife Refuge to protect existing aquatic, wetland, and riparian habitats and restore a mosaic of aquatic, perennial and seasonal emergent wetland, riparian, and grassland habitats.	9/30/2003	\$2,626,505	Complete.
ERP-98-F19	Cosumnes River Floodplain Acquisition, Restoration Planning, and Demonstration Supplemental funding for the acquisition of Denier property that was purchased in project ERP-97-N14.	9/30/2001	\$750,000	Complete, acquired 475 acres of agricultural land.
ERP-99-B13	Understanding Tidal Marsh Restoration Processes and Patterns: Validating and Extending the "BREACH" Conceptual Model Addressed considerable uncertainty in predicting the outcome and ecological benefit of restoring shallow-water tidal habitat in three different regions of the Bay Delta: the Delta, Suisun Bay, and San Pablo/North Bay.	6/30/2004	\$1,093,292	Complete refined conceptual models.
ERP-99-B26	1999/2000 Bay-Delta Education Program Increased the public's awareness and understanding of the issues affecting the Bay-Delta, and make it feasible for members of the public to support CALFED while altering their behavior to be a part of environmental solutions.	11/30/2000	\$32,300	Complete.
ERP-99-F03	Part B: The McCormack-Williamson Tracts Wildlife-Friendly Levee Management Project On the purchased McCormack-Williamson Tract (99-F04), The Nature Conservancy initiated startup stewardship, coordinated with agencies for restoration planning, and implemented a wildlife-friendly levee program.	12/31/2004	\$860,778	Complete.
ERP-99-F08	Purple Loosestrife Prevention, Detection & Control in the Sac/SJ Delta & Associated Hydrologic Units Over a 3 year period, the Integrated Pest Control Branch of the CA Dept of Food & Ag carried out a series of tasks which resulted in: 1. exhaustive survey of the Sacramento-San Joaquin Delta; 2. local eradication of loosestrife in Phase I and II areas; 3. focused delimitation and survey of all loosestrife infestations in the CALFED focus area; 4. training of agency personnel working in and near the Delta, to recognize purple loosestrife and other aquatic non-native invasive species; and 5. education of the boating, water fowl hunting, and similar public citizenry. Project is tied to ERP-99-N11 and ERP-99-N11b.	5/31/2003	\$221,306	Complete.

Table 1. Fresh Emergent Wetland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-N11	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Surveyed and mapped the non-native invasive plant species, purple loosestrife. This project developed a site specific adaptive management plan and comprehensive local eradication and control efforts.	1/10/2003	\$139,473	Complete.
ERP-99-N11b	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units This project continued early detection, prevention and eradication/control work for purple loosestrife in the Phase I and Phase II areas (these phases were funded to ERP-99-N11 and ERP-99-F08).	12/31/2003	\$49,865	Complete.

Other Programs Contributing to ERP Vision

Since 2001, Yolo Bypass Wildlife Area has added approximately 13,062 acres, bringing the total acres managed to 16,770 acres by 2005. Yolo Bypass Wildlife Area manages various habitat types including fresh emergent wetland. Approximately 550 acres have been identified as permanent wetland (CDFG 2007).

DFG has also created a vegetation classification system for Delta that can be used as a basis for conservation actions (Hickson and Keeler-Wolf 2007).

Status of Topic Today

Aside from the freshwater emergent wetlands passively restored on Liberty Island, ERP and the implementing agencies have not completed any additional major projects that provide freshwater emergent wetland habitat.

Owing to the fact that freshwater emergent wetlands are a part of shallow water habitat, see the discussion regarding the benefits of shallow water habitat in Section 4.3. Delta Sloughs, Status of Topic Today.

To meet stage 1 expectations, ERP needs to develop specific numeric objectives for each habitat type, with restoration objectives based on clearly stated conceptual models. Furthermore, within and among habitat types, conservation and restoration activities need to be prioritized.

Planned Projects for Implementation

Dutch Slough Tidal Marsh Restoration Project (ERP-02-C07-D) estimates that it can restore up to 483 acres of fresh emergent wetland. The Dutch Slough site was acquired by DWR in 2003. DWR and its partners have completed a restoration plan that is designed both to restore habitat and generate information about how best to restore Delta habitat in the future. The project is ready for implementation.

Impediments to Implementation

A major impediment to creation or restoration of freshwater emergent wetlands is the subsidence of much of the Delta. The combination of continuing subsidence and rising sea level makes attainment of ERP freshwater emergent wetlands targets for the central and west Delta more difficult than originally thought.

References

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- Feyrer, F., T. R. Sommer, S. C. Zeug, G. O'Leary, W. Harrell. 2004. Fish Assemblages of Perennial Floodplain Ponds of the Sacramento River, California (USA), With Implications for the Conservation of Native Fishes. *Fisheries Management and Ecology*. V. 11. P. 335-344.
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4. HABITATS

4.7. Seasonal Wetlands and Vernal Pools

Introduction

Bay-Delta seasonal wetlands include vernal pools, wet meadows or pastures, lands that are seasonally flooded, federal refuges, privately owned waterfowl hunting clubs, and private environmental refuge lands, and seasonally flooded areas within a stream course or its floodplain. Historically, seasonal wetlands occurred throughout the Central Valley. Vernal pools and wet meadows are probably best described as specialized components of terrestrial habitats. The remaining seasonal wetland types are flooded for periods that are too long to support characteristic upland vegetation.

Seasonal wetlands and aquatic habitats are important habitat areas for many species of fish and wildlife. Loss or degradation of historic seasonal wetlands has substantially reduced the habitat area available for waterfowl, shorebirds, and other wildlife. The loss of seasonal aquatic floodplain habitat has substantially reduced refuge habitat for fish and spawning habitat for the Sacramento splittail. Loss of vernal pools, seasonally flooded shallow areas, in particular, has directly resulted in the listing of several species as threatened or endangered under the federal Endangered Species Act.

Major factors that limit the contribution of this habitat type to the health of the Bay-Delta are related to adverse effects of land conversion, and substantial reductions in seasonal overbank flooding.

Applicable ERP Vision

The vision for seasonal wetlands is to increase the area and improve the quality of seasonal wetlands by restoring ecosystem processes that sustain them and reduce the effect of stressors that can degrade the quality of seasonal wetlands in order to assist in the recovery of special-status plant and animal populations, and provide high-quality habitat for waterfowl, water birds, and other wildlife dependent on the Bay-Delta.

The vision for vernal pools (from the Suisun Marsh/North San Francisco Bay EMZ) is to provide habitat for many listed plant and invertebrate species. Vernal pool protection and restoration will be closely linked to other actions related to restoring wetland, riparian, and adjacent upland habitats (note: only the Suisun Marsh/North San Francisco Bay EMZ has Vernal Pools separated out as a distinct habitat).

Stage 1 Expectations

The expectation during Stage 1 was that several large seasonal wetland projects would be initiated in the Delta. At least two of the projects were to be associated with floodplain process restoration projects. At least two projects were to be associated with restoring seasonal wetlands in heavily subsided areas where land elevations are too low to support actions to restore aquatic habitat.

Changes Attributable to ERP

Bel Marin Keys Unit V Expansion of Hamilton Wetlands (ERP-98-C03) will restore 277 acres of seasonal wetlands to the Bay Region. *Dutch Slough Tidal Marsh Restoration Project (ERP-02-C07-D)* which covers 1,166 acres estimates that it may restore up to 137 acres of seasonal wetland (identified in proposal as seasonal marsh & floodplain).

Restoring Ecosystem Integrity in the *Northwestern Delta - Jepson Prairie Restoration Phase II (ERP-02D-P54 and ERP-02-P21)* will acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, and north Delta tidal channels located west of the Yolo Bypass. **ERP-02-P21** will restore and manage vernal pools and perennial grasslands on 1,350 acres of the Wilcox Ranch and develop a management plan, covering an area approximately 20,000 acres, with specific guidance for approximately 6,000 acres. **ERP-2D-P54** will purchase of up to 1,100 acres of conservation easements on of top ranked properties bordering Calhoun Cut and Lindsey Slough as identified in the Site Conservation Plan for the Jepson Prairie-Prospect (JPP) Island Corridor and complete a feasibility analysis of landscape scale restoration on the publicly owned Calhoun Cut Ecological Reserve.

Stone Lakes NWR Land Acquisition (ERP-98-F12) acquired fee title to approximately 537.35 acres of land within the boundary of the Stone Lakes National Wildlife Refuge to protect existing aquatic, wetland, and riparian habitats and restored a mosaic of aquatic, perennial and seasonal emergent wetland, riparian, and grassland habitats. The actual amount of seasonal wetlands has not been documented.

Along the Cosumnes River more than 2,000 acres of land, of which an unspecified amount are seasonal wetlands, have been protected/enhanced/restored through four projects: *Cosumnes River Watershed Project - Valensin Ranch Acquisition (ERP-96-M06)*, *Cosumnes Start-up Stewardship and Restoration (ERP-97-N14)*, *Cosumnes Floodplain Acquisition and Restoration (ERP-98-B17)*, and *Cosumnes River Floodplain Acquisition, Restoration Planning, and Demonstration (ERP-98-F19)*.

Project Summary Table

Table 1. Seasonal Wetlands and Vernal Pools Project Summary

ERP Project Number	Project Name and Purpose	End Date	Total Funding	Project Status
ERP-00-B05	Adaptive Real-Time Water Quality Management of Seasonal Wetlands in the Grassland Water District Provided monitoring, modeling and adaptive management of field operations, in cooperation with the currently funded CALFED San Joaquin River Real-Time Water Quality Management Project, to coordinate seasonal wetland drainage with the assimilative capacity of the San Joaquin River for salinity.	6/30/2004	\$697,330	Complete.
ERP-00-E05	Merced River Corridor Restoration Project - Phase III Developed a publicly supported, technically sound, and implementable restoration plan for the Merced River corridor from Crocker-Huffman Dam downstream to the San Joaquin River.	11/1/2002	\$341,271	Complete.
ERP-00-F08	McCormack-Williamson Tract Restoration Planning, Design and Monitoring Program I This project will perform baseline studies necessary for project planning and design, and the development of long-term monitoring programs of the McCormack-Williamson Tract, which is a 1,600-acre Delta island.	8/1/2003	\$556,200	Completed research and planning for 1,512 acres of agricultural land.
ERP-01-N01	The Influence of Flood Regimes, Vegetative and Geomorphic Structures on the Links between Aquatic & Terrestrial Systems Examined the floodplain dynamics in the Cosumnes watershed by assessing levee breaches and other flow restoration efforts under which ecological succession is effective in restoring the structure and foodweb dynamics characteristic of functioning native ecosystems.	6/30/2006	\$2,652,750	Complete.
ERP-01-N40	Discover the Flyway II The Discover the Flyway program takes an ecosystem approach to educating teachers, students, and the general public about wetland ecosystems and habitats primarily in the Yolo Basin Ecological Management Zone.	8/1/2005	\$197,391	Complete.
ERP-02-C07-D	Dutch Slough Tidal Marsh Restoration Project (Phase I) Acquired the three contiguous parcels totaling 1,166 acres that comprise the Dutch Slough site.	12/31/2006	\$23,550,000	Complete.
ERP-02D-P54	Restoring Ecosystem Integrity in the Northwest Delta: Phase II Will acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, north Delta tidal channels located west of the Yolo Bypass.	8/31/2008	\$1,781,658	Ongoing acquisition of conservation easements on 1,100 acres of existing riparian, wetland and/or agricultural lands. Currently in the process of acquiring an agricultural easement on 292 acres.

Table 1. Seasonal Wetlands and Vernal Pools Project Summary

ERP Project Number	Project Name and Purpose	End Date	Total Funding	Project Status
ERP-02-P03-D	Dutch Slough Restoration Project This project will develop a restoration plan for a 1,166 acre site adjacent to Dutch Slough and the mouth of Marsh Creek in the western Delta.	11/2/2008	\$1,500,000	Ongoing.
ERP-02-P21	Restoring Ecosystem Integrity in the Northwest Delta: PHASE II Manage and restore up to 1,350 acres of perennial grassland/vernal pool complex in Solano County, CA, and develop a management plan for the Pembco property or other acquisition within the JPP Island Corridor.	8/31/2008	\$246,370	Ongoing, planning, outreach, experimental treatment plots, to determine restoration methods for 1,350 acres of various habitats (primarily perennial grasslands and vernal pools).
ERP-02-P25	McCormack-Williamson Tract Restoration: Wildlife-Friendly Levee Management Will reslope 20,000 linear feet of the backslope of the levees on the McCormack-Williamson tract (MWT) to a 5:1 slope using on-site fill to increase the strength and stability of the MWT levee system while increasing riparian habitat.	12/31/2008	\$2,476,835	Ongoing, levee backslopes will be restored with riparian vegetation (3.79 miles).
ERP-02-P46	At-Risk Plant Species, Habitat Restoration and Recovery, and Non-Native Invasive Species Management Managed and restored habitat quality of vernal pool wetlands, particularly for Crampton's tuctoria and alkali milk vetch, through eradication of non-native invasive species on 320 acres in Yolo County.	7/25/2006	\$400,000	Complete.
ERP-02-P49	Deer Creek Hills Project Acquired 294 acres of the Deer Creek Hills property. The site features blue oak woodland, vernal pools,	3/31/2004	\$800,000	Complete, also contains seasonal wetlands - vernal pools; perennial grassland, riparian and riverine aquatic - riparian; agricultural land - grazing; blue oak savannah.
ERP-05D-C02	Suisun Marsh Implementation Plan Support for the preparation of regional implementation plans in the Suisun Marsh.	6/30/2006	\$110,000	Complete.
ERP-05-S24	Farmer and Rancher Assisted Ecosystem Restoration and Watershed Stewardship Projects Conducts multiple projects on-the-ground within the Cow Creek Watershed. It is anticipated that the project will improve water quality, riparian health and ecosystem restoration. The stated project objectives are to (1) improve salmonid recovery in salmon-bearing streams and (2) improve current range and wetland facilities. Public outreach activities are also proposed.	2/28/2010	\$275,000	Ongoing. Thirty-seven project sites identified on 5 ranches will be improved.

Table 1. Seasonal Wetlands and Vernal Pools Project Summary

ERP Project Number	Project Name and Purpose	End Date	Total Funding	Project Status
ERP-05-S27	Rice-Cover Crop Rotation Pilot Program Seeks to implement a 3-year pilot project to benefit ground nesting birds, giant garter snakes, and other wetland dependent species through altered crop rotations and semi-permanent wetlands.	2/1/2011	\$1,649,051	Ongoing, creating 1,000 acres of wildlife friendly agriculture (Butte Basin EMZ).
ERP-05-S28	American Basin Working Landscapes Project Develops a GIS-based "working landscapes" model/plan for the American basin. Also, implements voluntary practices where appropriate, including easements, riparian restoration, wetland restoration, other on-farm, and farm-edge habitat restoration practices.	6/30/2010	\$1,860,898	Ongoing, creates 400 acres of wildlife friendly agriculture. Restores 28 acres of riparian vegetation and riverine corridors and 28 acres of natural wetland systems.
ERP-95-M05	M&T/Parrott Pumping Station and Fish Screen Project Involved relocation of M&T Ranches' Parrot-Phelan Pumping Station and implementation of fish screens on diversion structures to reduce fish entrainment on Big Chico Creek.	12/31/1997	\$1,610,000	Complete. Decommissioned old diversion (120 cfs) and relocated and constructed new diversion screened (150 cfs).
ERP-95-M07	Suisun Marsh Fish Screen Project Phase 1 (diversion evaluation and selection) of a larger program to construct fish screens on 5 diversions in the Suisun Marsh to reduce downstream migrant salmonid mortality and mortality of delta smelt and splittail.	12/31/1996	\$450,000	Complete. Installed fish screens on intake gate along Montezuma Slough, intake gates at Clubs 425, 426, 502, 506, and 634.
ERP-96-M06	Cosumnes River Watershed Project - Valensin Ranch Acquisition Acquired Valensin ranch and included it in the Cosumnes River Preserve.	12/31/1996	\$1,500,000	Complete. Protected 500 acres of seasonal and permanent wetlands, 270 acres of mature, closed canopy valley oak forest and 60 acres of vernal pools.
ERP-96-M13	Yolo Bypass Fish Habitat Examined the relationship between the Yolo Bypass and the rest of the Estuary and to developed recommendations for restoration actions that would improve Bypass habitat for fisheries and other aquatic organisms.	11/3/2000	\$226,000	Complete.
ERP-97-C03	Upper Sacramento River Fisheries and Riparian Habitat Management Program (SB 1086) Implementation: Watershed Management Planning Developed a non-profit watershed group that will implement the goals of the Upper Sacramento River Fisheries and Riparian Habitat Management Program (SB1086) to improve riparian habitat along the Sacramento River.	12/31/2000	\$200,000	Complete.

Table 1. Seasonal Wetlands and Vernal Pools Project Summary

ERP Project Number	Project Name and Purpose	End Date	Total Funding	Project Status
ERP-97-N03b	Sacramento River Floodplain Acquisition and Riparian Forest Restoration The Wildlife Conservation Board/Dept. of Fish and Game (DFG) actively restored 93 acres of flood-prone agriculture lands to native riparian forest along the Sacramento River between Keswick and Verona. This project increased shaded riverine aquatic habitat and improved degraded instream aquatic conditions. In addition, bird monitoring indicated the restored areas have dramatically improved existing riparian areas for bird usage.	11/1/2002	\$512,500	Complete. Beehive Bend (RM 169.5), 65.5 acres restored/converted from agricultural land to riparian. Thomas Unit (RM 166.5) 27.2 acres restored/converted from agricultural land to riparian.
ERP-97-N04	Sacramento River Meander Restoration Project acquires 80 acres of agricultural land and restores natural floodplain and river meander to the site. Goals include: increase extent of channel meander and flood zones, mapping of aquatic and terrestrial habitats, increasing native riparian growth and reducing exotic distribution adjacent to the river.	2/25/2001	\$898,700	Complete, acquired 94.55 acres of flood-prone agricultural land, and restored a 10 acre portion of it to riparian habitat. The remaining acres can still be farmed at owner's risk (Prune Orchard).
ERP-97-N10	Restoring Ecosystem Integrity in the Northwestern Delta - Jepson Prairie Restoration and Habitat Conservation Plan Restored habitat along two northwest Delta sloughs and adjacent perennial grasslands at Jepson Prairie.	9/30/2002	\$292,801	Complete. Converted 507 acres of agricultural grazing land to perennial grassland. Fenced 500 ft along the bank of Calhoun Cut and planted native plants to restore riparian and enhancing Delta Sloughs.
ERP-97-N14	Cosumnes Start-up Stewardship and Restoration Acquisition and planning for 2,341 acres of floodplain properties consisting of various habitat types (agricultural land, dairy, oak woodland, grasslands, seasonal wetlands). Includes clean-up and repair of the properties.	9/30/2002	\$2,305,730	Complete, various habitats acquired and cleaned-up in the Eastside Delta Tributaries EMZ.
ERP-98-B05	Sand and Salt Creek Watershed Project Supported Sand and Salt Creek Watershed project, which assists local landowners in reducing non-point source pollutions on primarily agricultural lands through the selection of 20 cooperating sites for implementation of Resources Management System (RMS) plans for the benefit of priority fish species.	12/31/2001	\$599,000	Complete.
ERP-98-B17	Cosumnes Floodplain Acquisition and Restoration Restored and improved floodplain functions. Restored riparian and wetland vegetation.	12/31/1998	\$3,500,000	Complete.
ERP-98-B34	Discover the Flyway Increased student awareness of wetlands and wildlife issues in the Yolo Basin.	12/31/2001	\$49,000	Complete, enhanced seasonal wetland planting 3,000 native sedge/grass plugs.

Table 1. Seasonal Wetlands and Vernal Pools Project Summary

ERP Project Number	Project Name and Purpose	End Date	Total Funding	Project Status
ERP-98-C03	Hamilton Wetlands Restoration Planning Provided planning and environmental documentation for the restoration of 2,500 acres of subsided, diked baylands to a mix of seasonal and tidal wetlands.	12/30/2002	\$1,070,030	Complete.
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program – CMARP Implementation of monitoring and applied research that provides data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.
ERP-98-C17	Assist in Developing Appraisal & Planning with TNC for the McCormack-Williamson Property The California Department of Water Resources provided services and support for the acquisition and initial site planning for the McCormack-Williamson Tract, including an appraisal, a legal transaction review, and initial planning activities.	11/30/2001	\$24,000	Complete.
ERP-98-E01	Napa River Watershed Stewardship Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/31/2000	\$250,000	Complete.
ERP-98-E03	San Francisco Bay Area Wetlands Ecosystem Goals Project Provided funds to enable the collection of data to be use in the creation of habitat goals which will be used by private, local, state, and federal entities seeking to protect and improve the San Francisco Bay Area's wetlands.	Unknown	\$76,000	Complete.
ERP-98-E09	Merced River Corridor Restoration Plan - Phase II Analyzed and quantified current in-channel, riparian, and floodplain conditions in the Merced River Corridor.	5/23/2001	\$345,443	Complete.
ERP-98-E12	Lower Mokelumne River Watershed Stewardship Program (Phase I) Facilitated broad based local stakeholder group in development of watershed plan, develop Environmental Farm plan and expand Neotropical bird monitoring for the Mokelumne River Watershed.	9/01/2000	\$159,000	Complete.

Table 1. Seasonal Wetlands and Vernal Pools Project Summary

ERP Project Number	Project Name and Purpose	End Date	Total Funding	Project Status
ERP-98-E13	Union School Slough Watershed Improvement Program The Yolo RCD together with Audubon-California enacted portions of the 1996 Willow Slough Integrated Resources Management Plan, which Union School Slough is a part. This project developed California's first "service" to assist landowners with conservation practices and formed a landowner stewardship group for information sharing, problem-solving, and "neighbor-convincing." Conservation activities included: 1) restoring upper watershed riparian areas and rangelands; 2) revegetating canals and drainage ditches; 3) constructing wildlife and tailwater ponds; and 4) restoring natural riparian function to the highly altered lower portion of the slough.	6/10/2002	\$636,000	Complete. Multiple habitats (including agricultural land - grazing; riparian and riverine aquatic - riparian) protective fencing, revegetation, controlled burns, seeding and pond construction. 1,190.7 acres.
ERP-98-F12	Stone Lakes NWR Land Acquisition Acquired fee title to approximately 537.35 acres of land within the boundary of the Stone Lakes National Wildlife Refuge to protect existing aquatic, wetland, and riparian habitats and restore a mosaic of aquatic, perennial and seasonal emergent wetland, riparian, and grassland habitats.	9/30/2003	\$2,626,505	Complete.
ERP-98-F19	Cosumnes River Floodplain Acquisition, Restoration Planning, and Demonstration Supplemental funding for the acquisition of Denier property that was purchased in project ERP-97-N14.	9/30/2001	\$750,000	Complete. Acquired 475 acres of agricultural land.
ERP-99-B02	Lower Butte Creek Project (Phase II: Preliminary Engineering and Environmental Analysis for Butte Sink Structural Modifications and Flow-Through System) Phase II of the Lower Butte Creek Project to improve fish passage through the Butte Sink and its associated water control structures by selecting the preferred alternative for design of major structural modifications at structures throughout the Butte Sink.	6/30/2002	\$900,000	Complete.
ERP-99-B26	1999/2000 Bay-Delta Education Program Increased the public's awareness and understanding of the issues affecting the Bay-Delta, and make it feasible for members of the public to support CALFED while altering their behavior to be a part of environmental solutions.	11/30/2000	\$32,300	Complete.
ERP-99-F03	Part B: The McCormack-Williamson Tracts Wildlife-Friendly Levee Management Project On the McCormack-Williamson Tract (99-F04), The Nature Conservancy initiated startup stewardship, coordinated with agencies for restoration planning, and implemented a wildlife-friendly levee program.	12/31/2004	\$860,778	Complete.

Table 1. Seasonal Wetlands and Vernal Pools Project Summary

ERP Project Number	Project Name and Purpose	End Date	Total Funding	Project Status
ERP-99-N11	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Surveyed and mapped the non-native invasive plant species, purple loosestrife. Developed a site specific adaptive management plan and comprehensive local eradication and control efforts.	12/31/2003	\$139,473	Complete. Detection, prevention, and control actions for purple loosestrife, created GIS layers and are available on website.
ERP-99-N11b	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Continued early detection, prevention and eradication/control work for purple loosestrife in the Phase I and Phase II areas (these phases were funded to ERP-99-N11 and ERP-99-F08).	12/31/2003	\$49,865	Complete.
ERP-99-N15	Lower Mokelumne River Watershed Stewardship Plan Program (Phase II/III) Continuation of a previously funded project by completing preparation of the Lower Mokelumne River Watershed Stewardship Plan/Watershed Owner's Manual, Action Plan, and Monitoring and Evaluation Program and implemented the Initial Watershed Stewardship Actions.	6/30/2002	\$227,000	Complete.
ERP-99-N18	Geomorphic Model for Demonstration and Feasibility Assessment of Setback Levees: Bay-Delta River Systems Developed a geomorphic model that allows simulation and demonstration of the response of riverine systems to levee removal and setback. Developed levee and infrastructure-placements component of this migration model; applied the model to simulate levee setback scenarios; developed interactive computer visualization of model output; and prepared model simulations, report and recommendations.	6/11/2004	\$104,458	Complete.

Other Programs Contributing to ERP Vision

Since 2001, Yolo Bypass Wildlife Area has added approximately 13,062 acres; bringing the total managed acres to 16,770 acres as of 2005. Yolo Bypass Wildlife Area manages various habitat types and currently has documented more than 1,700 acres of seasonal wetlands (EDAW 2007). A large amount, possibly more than 1,000 acres, of alkali playas and other seasonal wetlands are found on the 9,000-acre Tule Ranch unit of the Yolo Bypass Wildlife Area (EDAW 2007).

The vegetation classification system for the Delta and Suisun Marsh, developed by DFG, will help ERP in the monitoring of conservation actions (Hickson and Keeler-Wolf 2007, Keeler-Wolf and Vaghti 2000).

Status of Topic Today

Several large seasonal wetland projects have been initiated in the Delta. At least two of the projects are associated with floodplain process restoration. *Restoring Ecosystem Integrity in the Northwest Delta: PHASE II (ERP-02-P21)* has likely met the Vernal Pool Habitat targets for the Suisun Marsh/North San Francisco Bay EMZ. However no projects have been associated with restoring seasonal wetlands in the heavily subsided areas of the Delta.

Planned Projects for Implementation

There is opportunity for restoration within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, and north Delta tidal channels located west of the Yolo Bypass. Fully implementing *Restoring Ecosystem Integrity in the Northwest Delta: Phase II (ERP-02D-P54 and ERP-02-P21)* could easily meet some of the ERP targets for seasonal wetlands.

Impediments to Implementation

The very high risk of urbanization within or adjacent to the Delta continues to be a major impediment to seasonal wetland restoration in the Delta. Westhoff et al. (2007) developed a comprehensive map of urbanization risk in the Delta. Westhoff et al. (2007) determined that at least 75,000 acres of land was at very high risk of urbanization within or adjacent to the Delta.

References

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- Keeler-Wolf, T. and M. Vaghti. 2000. *Vegetation Mapping of Suisun Marsh, Solano County, California*. A report to the California Department of Water Resources. Prepared by California Department of Fish and Game Wildlife and Habitat Data Analysis Branch. December 30, 2000.
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4. HABITATS

4.8. Riparian and Riverine Aquatic Habitats

Introduction

Riparian and shaded riverine aquatic habitats are associated with shorelines of rivers and the Delta. Riparian vegetation includes scrub, woodland, and forest habitats that support a great diversity of wildlife species. Riverine aquatic habitat shaded by riparian vegetation, is important habitat for many species of fish, waterfowl, and wildlife.

Major factors that limit the extent of these habitats in Bay-Delta include historic riparian vegetation loss or degradation and near-shore aquatic habitat alteration from channelization, stabilization of channel banks with riprap, construction of levees, and control of flows.

Restoring riparian and riverine aquatic habitats will involve reactivating or improving natural physical processes. Stream meanders and sediment transport create and sustain these habitats, as well as increase their complexity and structural diversity. Natural streamflow patterns help sculpt healthy riparian and riverine aquatic habitats. High winter and spring flows trigger seed dispersal and germination, move sediment, stimulate stream meander, and flood and scour riparian and riverine habitat.

Natural stream channel meanders (often termed “meander belts”) provide healthy, high-quality riparian and riverine aquatic habitats. Channelizing rivers by constructing levees, protecting banks by adding riprap, and channel dredging hinder natural stream meander and natural river channel morphology.

Natural sources of gravel and other sediments along rivers and floodplains provide materials needed to create and sustain healthy riparian and riverine aquatic habitats. Where improvements to physical processes do not adequately restore riparian and riverine habitats, direct modification may be necessary to reach acreage and quality targets.

A major increase in floodplain riparian habitat will contribute sediment and nutrient to the rivers and estuaries. It will also improve the foodweb, and provide critical habitat for threatened and endangered terrestrial wildlife species, such as the yellow-billed cuckoo and Swainson’s hawk.

More extensive and continuous riparian forest canopy on the banks of estuaries and rivers will stabilize channels; help to shape submerged aquatic habitat structure; benefit the aquatic environment by contributing shade, overhead canopy, and instream cover for fish; and reduce river water temperature. More extensive and continuous shoreline

vegetation, providing woody debris (branches and root wads) and leaf and insect drop in shallow aquatic habitats, will increase the survival and health of juvenile salmonids, resident Delta native fishes, and introduced resident fishes. Achieving this objective will also greatly enhance the scenic quality and recreational experience of our Delta and riverine waterways.

Applicable ERP Vision

The vision for riparian and riverine aquatic habitats is to increase their area and protect and improve their quality to assist in the recovery of special-status fish and wildlife populations; and to provide high-quality habitat for other fish and wildlife dependent on the Bay-Delta.

Stage 1 Expectations

Stage 1 expectations were to develop a classification system for riverine and riparian habitats that can be used as a basis for conservation actions. An inventory of habitat types would be completed and areas prioritized for conservation actions. Restoration actions would be evaluated and initiated where feasible.

Changes Attributable to ERP

ERP acquired, through fee title or conservation easement, more than 11,048 acres and 18 river miles for restoration or protection. ERP enhanced or restored more than 3,908 acres and 59 miles of riparian and riverine aquatic habitat. These numbers are likely underestimates because many projects did not provide detailed habitat mapping and/or reporting.

A major research project, Sacramento River Ecological Flows Study (*Implementing a Collaborative Approach to Quantifying Ecosystem Flow Regime Needs for the Sacramento River* (**ERP-02D-P61**), focused on the mainstem Sacramento River corridor between Keswick Dam (RM 302) and Colusa (RM 143), including the channel, adjacent floodplain and riparian habitats, and off-channel water bodies. The study defined how flow characteristics (e.g. the magnitude, timing, duration, and frequency) and associated management actions (such as gravel augmentation and changes in bank armoring) influence the creation and maintenance of habitats for a number of native species that occur in the Sacramento River corridor. The study was composed of four primary tasks. The first was the State of the System (SOS) Report, which distilled existing information and presented conceptual models and hypotheses about ecological flow needs in the Sacramento River. The second task was a series of field

investigations and modeling applications designed to address data gaps and to refine estimates of ecological flow needs, including:

- A gravel study designed to characterize gravel quality, mobilization, and routing.
- An off-channel habitat study to estimate sediment deposition rates in, and resultant terrestrialization of, off-channel habitats.
- A bank study to examine the effects of natural and rip-rapped banks on aquatic habitat.
- A numerical chute cutoff model to predict the flows required to create a chute cutoff.
- A refined meander migration model.
- A sediment transport model that predicts the grain size distribution of both the surface and subsurface as a function of sediment supply and bed mobilization and scour.

The third task of the study was a decision analysis tool, referred to as the Sacramento River Ecological Flows Tool (SacEFT), designed to facilitate the analysis of ecological tradeoffs associated with different suites of management actions (ESSA Technologies 2005 & 2006). The fourth and final task component was a Final Report summarizing and synthesizing the results of the field investigations, modeling applications, and the application and recommended future uses of the SacEFT.

Establishing riparian vegetation is an important part of restoring riparian habitat. The following findings and recommendations were provided by the "Sacramento River Ecological Flows Study: State of the System Report" (Stillwater Sciences 2006):

- On the Sacramento River, successful cottonwood recruitment occurs at relative elevations of 3–9 ft above summer baseflow levels (Roberts et al. 2002, TNC 2003). Similar results have been observed along the lower Tuolumne and San Joaquin rivers, although the successful recruitment band in these smaller rivers tends to be at slightly lower elevations of 2–6 ft (McBain and Trush 2002, Stillwater Sciences 2003 and 2006a, Stella 2005).
- Field studies on Sacramento River point bars (TNC 2003a, Morgan 2005, Morgan and Henderson 2005a and 2005b) indicate that successful establishment of large cohorts of Fremont cottonwood seedlings are most likely to occur when water table/river stage declines at average rates of less than 0.8 in/day (Stillwater Sciences 2006a, Stella 2005, Morgan 2005, Morgan and Henderson 2005b). These studies also indicate that rates of decline in the range of 0.8 to 1.6 in/day are stressful to seedlings, but may still support survival of a smaller cohort of seedlings. It is also possible that steeper rates of river stage recession may be acceptable if they are offset by periods of 1 or more days of stable water levels, which would produce a stepped recession limb of the recruitment flow hydrograph (TNC 2003, Stillwater Sciences 2006a).

- Reductions in the magnitude and frequency of winter overbank flows in the post-dam era have presumably led to an overall decrease in soil moisture during the growing season for cottonwoods and other riparian plants. It has been hypothesized that this contributes to reduced growth rates and alters competitive interactions so that species more tolerant of drier conditions may become more dominant (Roberts et al. 2002, Stillwater Sciences 2006, Stella et al. 2006), resulting in more abundant box elder and walnut (Wood 2003, Vaghti 2003, Fremier 2003).
- The lower magnitude, and possibly altered timing, of spring flows may have affected cottonwoods by encouraging recruitment on low depositional surfaces that become inundated by subsequent winter floods or by elevated summer baseflows (Morgan 2005, Morgan and Henderson 2005a & 2005b, Stillwater Sciences 2006).
- Morgan (2005) concluded that there were three primary attributes of the current altered hydrograph that limit cottonwood seedling survival at the middle Sacramento River study sites: 1) the reversal of summer flows such that there is now a trend of increasing summer flow levels during cottonwood seed release and seed germination periods, 2) rapid stage declines during the spring pulse flow such that root growth in seedlings established during the typical recruitment period cannot keep up with declining water levels, and 3) the immediate drop in stage late in the growing season when reservoir releases for summer irrigation cease.
- To promote riparian vegetation recruitment and establishment in the Sacramento River corridor, the State of the System report (Stillwater Sciences 2006) recommended that agencies:
 1. Manage the recession limb of spring high flow events in wet water years to promote seedling establishment of cottonwoods and willows.
 2. Promote channel migration to create new seedbeds for cottonwood recruitment through scour and fine sediment deposition.
 3. Promote strategic horticultural restoration on higher floodplains surfaces where passive recruitment is infeasible.
 4. Prioritize actions to eradicate and control invasive plant species.

A predictive model for recruitment of cottonwoods and willows on the Lower San Joaquin Basin has been developed by *A Mechanistic Approach to Riparian Restoration in the San Joaquin Bay (ERP-00-F04)* (Stillwater Sciences 2006a). Physical and biological mechanisms affecting establishment of riparian vegetation were identified in order to identify the most cost-effective strategies and sites for riparian protection and restoration. Three practical applications are 1) designing ecologically-beneficial flow

releases; 2) projecting spatial recruitment patterns at individual floodplain sites or throughout a river corridor; and 3) projecting the impact of climate-driven changes in the flow and temperature regimes.

Indexing flow planning for water year type is an important tool to use to promote the recruitment of riparian vegetation. Using the California Department of Water Resources (CDWR) water year classification for the San Joaquin and Sacramento rivers, a dual approach to flow management for riparian vegetation issues was recommended (Table 1): 1) for wet and above-normal years, a focus on seedling recruitment and 2) in all other years, a focus on survival of seedlings recruited in previous years by sustaining groundwater levels in summer (Stillwater Sciences 2006a). The report for *A Mechanistic Approach to Riparian Restoration in the San Joaquin Bay* (**ERP-00-F04**) goes into detail about modeling recruitment flows. It is an excellent resource for planning and management of riparian habitat.

Table 1. Primary Riparian Flow Management Objectives, by Water Year Type

Water Year Type	Approximate Percent of Years	Management Objectives
Wet and Above-Normal	40%	Spring recruitment flows to establish seedlings on lower floodplains, with summer flow conditions sufficient to maintain seedlings on desired surfaces.
Below-Normal, Dry, and Critically Dry	60%	No planned recruitment. Need to maintain summer water table for young cohorts

River Partners studied the issue of flood conveyance verses revegetation. Using two-dimensional hydraulic modeling as a planning tool, they showed that flood-neutral riparian revegetation can be designed within a floodway with careful planning for the hydraulic effects of flood flows (Griggs 2007).

Protecting riparian vegetation is one of the purposes of biotechnical bank protection. Brush boxes were a biotechnical bank protection measure utilized to restore habitat in the Sacramento-San Joaquin Delta (*Tyler Island Levee Protection and Habitat Restoration Pilot Project* (**ERP-97-N13**)). Brush boxes were found to decrease erosional processes and favor depositional processes. They also maintained planted species and recruited others. According to Hart and Hunter (2004), the most promising use of these biotechnical structures is in those situations where a calming period is required to establish plants, after which they would be self-sustaining.

Several projects contributed to meeting the Stage 1 expectation that riverine and riparian habitats would be mapped in order to help prioritize conservation actions.

The Sacramento River Riparian Mapping Project (**ERP-96-M16**) developed inventories and maps of riparian lands along the Sacramento River and its major tributaries. The study area was confined to streams in the Sacramento Valley, and mapping ended in

the foothill canyons on both sides of the Valley. The project was done in four phases: Phase 1 included southern Shasta County, Phase 2 included Tehama County, Phase 3 included Butte County, and Phase 4 included the Sacramento River mainstem to Suisun Bay, the Feather, American, Yuba, and Bear Rivers, Butte Sink, the Sutter Bypass, and Stony, Cache, and Putah Creeks on the west side.

In support of Stage 1, *Digital Soil Survey Mapping and Digital Orthophotoquad Imagery Development (ERP-01-N30)* produced two digital data layers for 9 Soil Survey Areas. These two layers are a Digital Orthophotoquad (DOQ) layer and a certified electronic digital soils data layer with accompanying soil property and interpretations attribute tables. The nine study areas are located in the Shasta Area, Glenn County, Nevada County, the Amador Area, the Eastern Stanislaus Area, the Merced Area, the Madera Area, Tehama County, and Sonoma County.

Another project, *Geomorphic and Geologic Mapping for Restoration Planning (ERP-02-P45)*, mapped geomorphic landforms and geologic deposits along the lower Sacramento, San Joaquin, and Cosumnes rivers for input into ecosystem restoration planning and levee engineering. The maps show: 1) the distribution of historical river landforms (including natural levees, floodplains, and stream channels) for floodplain and habitat restoration; 2) likely locations of historic hydraulic mining-derived sediments stored along the river margins; and 3) the likely composition of foundation materials underlying existing levees for evaluation of levee stability.

Several additional projects have contributed to mapping of riparian and riverine aquatic habitats (see Other Program Contributions to ERP Vision).

Several projects, some of which have been funded by ERP, have demonstrated techniques for monitoring the success of riparian restoration projects in addition to providing data on the current success of ERP.

Holl and Crone (2004) sampled naturally colonizing riparian forest understorey plant communities in 15 riparian forests restored by planting native woody species along a 150-km stretch of the Sacramento River (*Implementing a Collaborative Approach to Quantifying Ecosystem Flow Regime Needs for the Sacramento River (ERP-02D-P61)*). They found cover and species richness of exotic understorey plants decreased strongly with increasing overstorey cover, and were lower in quadrats closer to river base flow. Native understorey species richness and cover were negatively related to exotic cover and positively related to connectivity with remnant forest. Based on their findings they recommended that efforts to restore understorey plant communities in this highly fragmented system should focus on local-scale restoration methodologies, such as increasing cover of native overstorey species and reducing cover of exotic plants.

Restoration activities along the Sacramento River are successfully providing habitat for a diverse community of landbirds. Bird monitoring provides a meaningful way to

evaluate restoration success. *Songbird Population Responses to Riparian Management and Restoration at Multiple Scales: Comparative Analysis, Predictive Modeling, and the Evaluation of Monitoring Program (ERP-02-P17)* conducted surveys of landbirds on revegetated and remnant riparian plots from 1993 to 2003. Of the 20 species examined, nine species were increasing on revegetated and remnant plots, four were increasing on revegetated plots only, three were increasing on remnant plots only, the Lazuli Bunting (*Passerina amoena*) was decreasing on both, and three species were stable on both. Although many species were increasing at a faster rate on revegetated plots, their abundance did not reach that of the remnant plots. For revegetated plots, "year since planting" was a strong predictor of abundance trends for 13 species: positive for 12, negative for 1 (Gardali et al. 2006).

See Other Program Contributions to ERP Vision for additional contributions to monitoring of riparian and riverine aquatic habitats.

Project Summary Table

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
CVPIA-01-F02	Spawning Habitat & Floodplain Restoration in the Stanislaus River, Phase I Restored spawning and rearing habitat for salmonids in the Lover's Leap reach on the lower Stanislaus River.	Unknown	\$672,610	Complete. Gravel infusion.
CVPIA-01-F03	Non-Structural Alternative at the San Joaquin River National Wildlife Refuge: Refinement for Habitat Enhancement Conducted an engineering and hydraulic analysis of the proposed non-structural flood control alternative (NSA) within the San Joaquin National Wildlife Refuge (SJNWR) to evaluate frequency, duration, and location of floodplain inundation and to predict potential benefits and impacts to anadromous fish.	3/31/2005	\$312,451	Complete.
CVPIA-01-F04	Tuolumne River Watershed Outreach and Stewardship Fostered local watershed stewardship through involvement and participation in implementation of the Tuolumne River Restoration Plan.	9/30/2002	\$62,000	Complete.
CVPIA-01-F12	Lower Calaveras River Chinook Salmon and Steelhead Life History Limiting Factors Analysis Refined the understanding of how water management, in conjunction with other factors, limits the ability of Chinook salmon and steelhead to establish self-sustaining populations in the Calaveras River.	6/30/2006	\$500,797	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
CVPIA-01-F14	Tuolumne River Mining Reach Restoration No 3 - Warner-Deardorff Segment Completed the design engineering started under the MJ Ruddy Project, engineering for the ROW acquisition, and the pre-project monitoring for the Warner-Deardorff segment of the Tuolumne River Mining Reach project.	12/31/2005	\$518,670	Complete.
ERP-00-B04	Focused Action to Develop Ecologically-based Hydrologic Models and Water Management Strategies in the San Joaquin Basin Identified flow regimes that have a widespread effect on the entire length of the San Joaquin River tributaries, Delta and San Francisco Bay through analysis and modeling of hydro-biologic issues and water management.	3/30/2003	\$295,925	Complete.
ERP-00-E03	Cottonwood Creek Watershed Monitoring and Assessment Continued management of the Cottonwood Creek Watershed Group to oversee the implementation of a watershed plan. Assessed current conditions in the watershed, both as to the land and stream conditions, and to give a baseline for future projects.	12/31/2003	\$350,000	Complete.
ERP-00-E04	Sonoma Creek Watershed Conservancy Implemented riparian and aquatic habitat restoration activities and continued watershed stewardship and education programs in the Sonoma Creek watershed.	3/1/2004	\$438,923	Complete. Funded 800 ft. of riparian restoration by revegetating streambanks at 3 different sites on Carriger Creek.
ERP-00-E05	Merced River Corridor Restoration Project - Phase III Developed a publicly supported a technically sound, implementable restoration plan for the Merced River corridor from Crocker-Huffman Dam downstream to the San Joaquin River.	11/1/2002	\$341,271	Complete.
ERP-00-F01	Tuolumne River Bobcat Flat Floodplain Acquisition Project Comprised of 3 parcels offered to Friends of the Tuolumne (FOT) by 2 willing sellers.	11/1/2006	\$1,984,320	Complete. 303 acres/1.6 miles river frontage were acquired and restored to various habitat types, specific acreage by type were not reported.
ERP-00-F03	Floodplain Acquisition and Sub-reach/Site Specific Management Planning on the Sacramento River (Red Bluff to Colusa) Acquisition of 9 parcels (1,733 acres) within the SB 1086 Sacramento River Conservation Area (Red Bluff to Colusa); baseline assessment/start-up stewardship for newly acquired parcels; site-specific management	9/30/2003	\$519,000	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-F04	A Mechanistic Approach to Riparian Restoration in the San Joaquin Basin Identified the physical and biological mechanisms affecting establishment of riparian vegetation, in particular Fremont cottonwood and willow communities in the San Joaquin Basin, in order to identify the most cost-effective strategies and sites for riparian protection and restoration.	3/31/2006	\$293,532	Complete.
ERP-00-F06	Liberty Island Acquisition Acquired fee title interest in the remaining two privately-owned properties on Liberty Island, estimated at 449 acres; and to conduct restoration of tidal shallow water habitat, tidal emergent wetlands, and seasonal wetlands for aquatic and terrestrial species.	9/30/2007	\$2,625,153	Complete.
ERP-00-F07	McCormack-Williamson Tract Restoration Planning, Design and Monitoring Performed baseline studies necessary for project planning and design, and developed a long-term monitoring program for the 1,600-acre McCormack-Williamson Tract Delta island.	12/31/2007	\$355,000	Complete.
ERP-00-F08	McCormack-Williamson Tract Restoration Planning, Design and Monitoring Program I Performed baseline studies necessary for project planning and design, and the development of long-term monitoring programs of the McCormack-Williamson Tract (M-W), which is a 1,600-acre Delta island.	8/1/2003	\$556,200	Complete.
ERP-00-F11	<i>Arundo donax</i> Eradication and Coordination Directed eradication and monitoring funds for on-the-ground eradication of <i>Arundo</i> , the state's most invasive riparian weed, to eradication partners in six watersheds. In addition, this project coordinated data collection, establishing standardized eradication and monitoring protocols and creating an online clearinghouse.	3/26/2006	\$1,063,595	Complete.
ERP-01-C03	Revised Phase II - Merced River Salmon Habitat Enhancement River Miles 42 to 44 (Robinson Reach and Permit #307 sites) Restored a reach of the Merced river: channel reconfiguration, creation of a large floodplain with native vegetation, and berm reconstruction to reduce predation of non-native fish on native species.	6/30/2004	\$1,699,101	Complete. Scaled and reshaped channel, replanted floodplain, riparian and riverine aquatic – both instream and riparian, over the entire 2 mile reach.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-C11	Technical/Scientific Review of Upper Yuba River Studies Program: Hydrotechnical Engineering Expert Provided technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program. As a member of the Technical Review Panel, the Contractor reviewed materials, attended workshops, participated in discussions, responded to inquiries and presented findings and advice. A three-day workshop was held during September 2001 during which the technical details of the proposed work on the UYRSP were discussed.	6/30/2006	\$28,000	Complete.
ERP-01-N01	The Influence of Flood Regimes, Vegetative and Geomorphic Structures on the Links between Aquatic & Terrestrial Systems This project examined the floodplain dynamics in the Cosumnes watershed by assessing levee breaches and other flow restoration efforts under which ecological succession is effective in restoring the structure and foodweb dynamics characteristic of functioning native ecosystems.	6/30/2006	\$2,652,750	Complete.
ERP-01-N03	Tuolumne River Restoration: Special Run Pool 10 Improved salmon spawning and rearing habitats and reduced predator habitat (bass) by filling the in-channel mining pits; preventing future connections between the River and the off-channel mining pit and restoring native riparian habitats.	6/30/2006	\$652,030	Complete.
ERP-01-N04	<i>Arundo Donax</i>: Survey and Eradication Identified and eradicated areas infested by <i>Arundo donax</i> and <i>Tamarix</i> on Red Bank Creek, and Reed's Creek.	12/31/2006	\$539,836	Complete. Project area encompassed ~630 acres of streambed and banks and 16.7 km of stream channel. On Red Bank Creek, the project focused on <i>Tamarix</i> . Eradication on Reed's Creek focused on <i>Arundo</i> .
ERP-01-N08	San Joaquin River NWR Riparian Habitat Protection & Floodplain Restoration Project - Phase II Funded easement acquisition. Restored riparian and wetland habitat. Reintroduced riparian brush rabbits. Monitor. Associated project (ERP-97-B04) for Phase I.	12/31/2006	\$7,968,112	Complete. Acquired 361.97 acres of riparian and riverine aquatic - riparian, seasonal wetland - connected. 808 acres reported restored were riparian habitat.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-N10	<p>Cosumnes/Mokelumne Corridor Floodplain Acquisitions, Management, and Restoration Planning</p> <p>Planning phase, which included acquisition. Phase I of a two-part flood management and ecosystem restoration project in Sacramento County, which will ultimately result in 600 acres of land along the Cosumnes and Mokelumne Rivers incorporated into non-structural flood management practices of the Cosumnes River Preserve. Phase 1 identified and acquired, from willing sellers, suitable parcels and conduct start-up stewardship activities, including baseline monitoring and preliminary restoration planning.</p>	6/30/2007	\$3,044,342	Complete. Acquired Siverado-Valley Oak Tract 122.07 acres; wildlife friendly agriculture, seasonal wetlands, uplands, and vineyards. Acquired Giovannoni property 648.77 acres; conservation easement to prohibit planting of permanent crops like vineyards or orchards. Acquired CE on Cowell property 25 acres (Delta EMZ). Acquired Oneto, 129 acres Eastside Tributaries (EMZ).
ERP-01-N11	<p>Habitat Acquisition for Riparian Brush Rabbit and Riparian Woodrat</p> <p>Acquired fee title or conservation easements on 371.15 acres of riparian habitat to provide secure sites for release of captive-bred riparian brush rabbits.</p>	12/31/2006	\$2,720,085	Complete.
ERP-01-N24	<p>Battle Creek Conservation Easements Acquisitions, Management, and Restoration Planning</p> <p>Funded the acquisition of conservation easements on three properties in the Battle Creek watershed for the benefit of Chinook salmon and steelhead restoration efforts.</p>	10/31/2004	\$1,000,000	Complete. Acquired Miller (Burton) Ranch, 3 miles of stream length, 1,511 acres; Winning Ranch 700 acres; 2 miles of stream length, 988 acres (pristine riparian, upland agriculture, fresh emergent wetland, perennial grasses, irrigated pasture, blue oak woodland)
ERP-01-N26	<p>Lassen National Forest Watershed Stewardship Within the Anadromous Watersheds of Butte, Deer and Mill Creeks</p> <p>Restored Butte, Deer, and Mill Creek watersheds through implementation of various restoration activities, including a public outreach element aimed at improving habitat for anadromous fish within these watersheds.</p>	11/15/2004	\$849,845	Complete. Treated 2.25 miles of decommissioned roads, and more than 45 sites to reduce erosion and sediment.
ERP-01-N27	<p>Sonoma Creek Watershed Conservancy</p> <p>Expanded on the Conservancy's existing efforts to inform and engage the public in watershed issues while providing critical data for adaptive management.</p>	10/30/2005	\$545,170	Complete.
ERP-01-N28	<p>Sacramento River Conservation Area Program</p> <p>Funded efforts of the Sacramento River Conservation Area Program to act as a coordinating body between local, state, and federal agencies regarding restoration activities in the Sacramento River watershed.</p>	6/30/2007	\$1,034,249	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-N30	Digital Soil Survey Mapping and Digital Orthophotoquad Imagery Development Made soils information more accessible to individuals and groups engaged in ecosystem restoration projects in the Bay-Delta Region, and in doing so, improve the responsiveness of these projects to establishing habitat and supporting sustainable populations of valuable species.	8/15/ 2004	\$430,390	Complete.
ERP-01-N31	Willow Slough Watershed Rangeland Stewardship Program Built on restoration efforts in the Willow Slough watershed to enhance and restore riparian and grassland habitats, improve forage quality, improve water quality, and reduce erosion. www.plantbiology.msu.edu/malmstrom/Audubon/index.htm	12/31/2005	\$1,800,668	Complete. Enhanced/restored 843 acres of grassland, enhanced 98 acres/ 5.95 miles of riparian.
ERP-01-N32	Marsh Creek Watershed Stewardship A watershed stewardship project that will lead to the protection and restoration of Marsh Creek. The goal of the Watershed Science Program is to organize and implement a community-based watershed analysis to improve scientific understanding of ecological trends and processes shaping Marsh Creek, thus building a knowledgeable local constituency.	6/30/2003	\$126,000	Complete.
ERP-01-N33	Watershed Education, Headwaters to Ocean Funded for five different education outreach programs conducted by the Sacramento River Discovery Center aimed at educating citizens about natural systems.	2/28/2005	\$321,816	Complete.
ERP-01-N34	Estuary Action Challenge Environmental Education Project EAC worked with elementary school teachers and students to explore, clean up, and restore creek and bay habitats, reduce urban runoff pollution and address issues of water quality and safe bay food consumption. Programs took place in various locations around the Bay Area.	11/30/2001	\$50,000	Complete.
ERP-01-N41	Bay-Delta Learning Initiative Produced and distributed educational posters, directed at boaters and anglers, to teach them about plant and pest non-native invasive species; and provided the media with an overview of current topics and provided workshops and teaching materials for teachers for greater awareness of and appreciation for the Bay-Delta ecosystem.	3/31/2004	\$126,668	Complete.
ERP-01-N57	Lower Mokelumne River Restoration Program - Phase 2 Prepared design and specifications for a proposed fish screen system along the Lower Mokelumne River.	2/28/2002	\$680,000	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-N62	Yuba Feather Work Group Supported a community-based stakeholder approach to providing input into Yuba County Water Agency's Proposition 13 Yuba Feather Flood Control Study on various non new-dam watershed management techniques to enhance flood protection while maintaining or improving natural process, habitat and populations of high priority at-risk species, including Chinook salmon and steelhead.	8/31/2006	\$297,632	Complete.
ERP-02-C02-D	Upper Yuba River Studies Program: Engineering, Environmental Services, Project Management and Facilitation Determined if the introduction of wild Chinook salmon and steelhead trout to the upper Yuba River watershed is feasible in the long term. CH2M Hill performed services defined by CALFED in writing, under individual task orders.	6/30/2006	\$4,422,038	Complete.
ERP-02-C05-D	Hamilton City Flood Damage Reduction and Ecosystem Restoration Completed the Hamilton City feasibility study to restore connection to the floodplain and restore 2,600 acres of riparian habitat in the Hamilton city area, while simultaneously reducing the flood risk to local residents.	6/30/2006	\$483,500	Complete.
ERP-02-C07-D	Dutch Slough Tidal Marsh Restoration Project (Phase I) Acquired the three contiguous parcels totaling 1,166 acres that comprise the Dutch Slough site.	12/31/2006	\$23,550,000	Complete.
ERP-02-C08	Restoration of Eastern Delta Floodplain Habitats on Grizzly Slough in the Cosumnes River Watershed - Phase I Phase 1 in an effort to restore function to an historic seasonal floodplain on Grizzly Slough in the Cosumnes River watershed.	6/30/2006	\$300,000	Complete.
ERP-02D-C11	Recovery Implementation for Riparian Brush Rabbit and Riparian Woodrat on the Lower Stanislaus River Was ERP-02-P25-D and then was 02D-P59. This project will restore riparian habitats along the lower Stanislaus and San Joaquin rivers adjacent to the Caswell State Park and the SJ river National Wildlife Refuge.	11/30/2008	\$6,427,131	Ongoing. Acquired 184.34 acres along the Stanislaus River, adjacent to San Joaquin River National Wildlife Refuge.
ERP-02D-P54	Restoring Ecosystem Integrity in the Northwest Delta: Phase II Proposes to acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, north Delta tidal channels located west of the Yolo Bypass.	8/31/2008	\$1,781,658	Ongoing. Acquisition of conservation easements on 1,100 acres of existing riparian, wetland and/or agricultural lands. Currently in the process of acquiring an agricultural easement on 292 acres.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02D-P60	Pacific Flyway Center Initial Planning Project Funds the initial planning phase of the Pacific Flyway Center (PFC), a proposed educational facility and site intended to serve the public.	1/3/2008	\$334,021	Complete.
ERP-02D-P61	Implementing a Collaborative Approach to Quantifying Ecosystem Flow Regime Needs for the Sacramento River Quantified key aspects of a "naturalized" flow regime that are compatible with flood damage reduction, agriculture, diversions, storage and conveyance. (was ERP-02-P15-D)	9/9/2007	\$1,571,438	Complete.
ERP-02D-P65	Sacramento River Restoration: Chico Landing Sub-Reach (RM 178-206) Will conduct restoration planning and research on three sites within the Chico Landing Sub-reach (RM 178-206) in preparation for future restoration; and in a set of reference sites that were previously restored by a contractor 5-13 years ago. All sites are located within a portion of the Sacramento River Conservation Area.	1/31/2010	\$3,961,131	Ongoing.
ERP-02D-P66	Cosumnes River Preserve Perennial Pepperweed Control Project Based on inventory and continued monitoring of existing <i>Lepidium</i> populations at the Cosumnes River Preserve, this project developed targeted research about control of <i>Lepidium</i> focused on physical and chemical aspects of the soil and on the response of surrounding vegetation to <i>Lepidium</i> populations.	12/31/2007	\$481,634	Complete.
ERP-02D-P68	Arundo Eradication and Coordination, Phase II This is Phase II of the <i>Arundo donax</i> eradication and coordination project. Phase II provides funding for ongoing monitoring and follow-up treatments for 5 Phase I projects, and adds 5 new partners. This project aims to remove approximately 273 acres of Arundo on over 63 miles of rivers and creeks.	3/15/2009	\$2,033,859	Ongoing. <i>Arundo</i> eradication on 5 new sites: Gray Lodge Wildlife Area, Lindo Ck, Lower American R, San Joaquin R, Upper Cache Ck.
ERP-02-P02	Upper Cosumnes River Watershed Conservation Project Acquired land totaling approximately 1,814 acres of riparian and upslope habitat along the North Fork of the Cosumnes River, within the Upper Cosumnes River Basin.	2/19/2004	\$2,000,000	Complete. Acquired 1,814 acre of conservation easement (Agricultural land - Grazing) on Morales property.
ERP-02-P03-D	Dutch Slough Restoration Project Developing a restoration plan for a 1,166-acre site adjacent to Dutch Slough and the mouth of Marsh Creek in the western Delta.	11/1/2008	\$1,500,000	Ongoing.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P10	Estuary Action Challenge Environmental Education Program Hands on environmental education project focusing on local water resources and environmental justice issues in underserved urban communities. In this contract work with elementary school teachers and students to explore, clean up and restore creek and bay habitats, reduce urban runoff pollution and address issues of water quality and safe bay food consumption will be performed.	7/10/2004	\$120,000	Complete.
ERP-02-P12	Sustainable Restoration Technologies for Bay/Delta Tidal Marsh and Riparian Habitat Protected natural embankment and reconstruction through passive recruitment of new sediment to create new riparian and shaded riverine aquatic habitat in aquatic channels.	12/30/2006	\$1,800,000	Complete. Restored 3.72 river miles (1.99 miles in East Delta, 0.5 miles in North Delta, 0.81 miles in Central and West Delta, 0.42 miles in the Suisun Marsh and Bay) of riverbank, levee and shoreline tidal environments to riparian and marsh habitats.
ERP-02-P16-D	Restoration of the Confluence Area of the Sacramento River, Big Chico and Mud Creeks Phase II of a four-phase project to protect and restore 311 acres of flood prone, ecologically significant land located within the Sacramento River Conservation Area at the confluence of the Sac. R, Big Chico and Mud Creeks at river miles 194-195. The goal is to protect and complete restoration and management planning for three properties located in Butte County; the Nicolaus, Nock and Singh properties. Will improve the viability of at-risk species by protecting and restoring riparian habitat and rehabilitating floodplain processes, increasing the knowledge of ecosystem function, reducing flood damage to important human infrastructure by increasing floodwater storage in project area, and improving water quality.	6/30/2008	\$2,603,377	Ongoing. Acquired 146.03 acres within the active meander zone of the Sacramento River, Big Chico and Mud Creeks.
ERP-02-P17	Songbird Population Responses to Riparian Management and Restoration at Multiple Scales: Comparative Analysis, Predictive Modeling, and the Evaluation of Monitoring Programs The applicant synthesized the results of past and current riparian bird system research and monitoring across the entire CALFED region. They identified the major factors influencing the success of hydrological, vegetation management, and restoration activities in providing habitat for self-sustaining bird populations, developed recommendations for how such activities can best benefit breeding songbirds and evaluated the songbird monitoring strategy.	7/31/2007	\$356,876	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P20	Restoration and Monitoring of Riparian Habitat Corridors Along The Lower Mokelumne River Restored 50.45 acres of riparian habitat along two miles of Lower Mokelumne River for birds. Restored degraded riparian ecosystems through invasive species removal and native plant restoration and to monitor the response of neo-tropical migrant songbirds to the restoration.	1/31/2007	\$859,405	Complete.
ERP-02-P21	Restoring Ecosystem Integrity in the Northwest Delta: PHASE II Manage and restore up to 1,300 acres of perennial grassland/vernal pool complex in Solano County, CA, and develop a management plan for the Pembco property or other acquisition within the JPP Island Corridor.	8/31/2008	\$246,370	Ongoing.
ERP-02-P25	McCormack-Williamson Tract Restoration: Wildlife-Friendly Levee Management Reslope 20,000 linear feet of the backslope of the levees on the McCormack-Williamson tract (MWT) to a 5:1 slope using on-site fill to increase the strength and stability of the MWT levee system while increasing riparian habitat.	12/31/2008	\$2,476,835	Ongoing, levee backslopes will be restored with riparian vegetation (3.79 miles).
ERP-02-P26	Mill and Deer Creeks Protection and Stewardship Addresses water quality and quantity, salmon habitat, and existing wildlife-friendly agriculture on Mill Creek and Deer Creek through conservation easements and active land stewardship.	12/31/2007	\$4,700,000	Complete. Conservation easement on 23,459 acres, protected (fenced) 1.6 miles, 387 acres of riparian.
ERP-02-P27	Sub-Reach Planning for the Sacramento River: River Mile 144-164 Leads planning efforts for the Colusa-Princeton Sub-reach of the Sacramento River (RM 144-164)) sub-reach planning is site-specific at a spatial scale of approximately 20 river miles. This is a comprehensive approach to restoration planning that includes a high level of stakeholder involvement to develop conceptual restoration plans and analyzes potential benefits to, and impacts of, restoration implementation on surrounding landowners and land uses.	4/14/2008	\$1,488,009	Ongoing.
ERP-02-P39	Riparian Restoration Planning and Feasibility Study for the Riparian Sanctuary, Llano Seco Unit Identified feasible management options that will 1) improve habitat and ecosystem processes on 950 acres of the Riparian Sanctuary at the Sacramento River National Wildlife Refuge, Llano Seco Unit; 2) develop and evaluate ecological acceptable options that would improve pumping plant protection and, 3)increase scientific understanding of riparian restoration projects	2/28/2006	\$289,784	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P45	Geomorphic and Geologic Mapping for Restoration Planning Mapped geomorphic landforms and geologic deposits along the lower Sacramento, San Joaquin, and Cosumnes rivers for input into ecosystem restoration planning and levee engineering. Detailed mapping (1:24,000) will be completed for portions of nine 7.5 minute quadrangles.	06/1/2005	\$120,000	Complete.
ERP-02-P49	Deer Creek Hills Project Acquired 294 acres of the Deer Creek Hills property. The site features blue oak woodland, vernal pools,	3/31/2004	\$800,000	Complete. Contains seasonal wetlands - vernal pools; perennial grassland, riparian and riverine aquatic - riparian; agricultural land - grazing; blue oak savannah.
ERP-04-S05	Lower Clear Creek Monitoring Program Avian Monitoring, Geomorphic Monitoring, and Riparian Habitat Monitoring.	1/31/2010	\$1,308,449	Ongoing
ERP-04-S11	Sacramento River Riparian Monitoring and Assessment Consolidated Projects Addresses Sacramento River corridor riparian vegetation restoration effectiveness and biological response as a function of time, location, restoration technique, river channel migration, and other natural processes. Will quantitatively assess the extent to which past ERP funded restoration projects have achieved their stated goals, and through a scorecard approach will provide a means to track ERP project changes over time.	6/30/2009	\$1,261,057	Ongoing.
ERP-05D-C01	Hamilton City Flood Damage Reduction and Ecosystem Restoration Project Preconstruction, engineering, and design phase to prepare final design plans and specifications for construction.	11/30/2008	\$1,020,100	Ongoing planning for restoration of 1,500 acres of riparian communities, as well as construction of a 7 mile long setback levee.
ERP-05D-S02	Data Collection for the San Joaquin Basin-wide Temperature Model Funds DFG to carry out the support activities related to collecting, storing, and managing water temperature and meteorological data in support of developing the San Joaquin River Basin-Wide Water Temperature	6/30/2008	\$781,000	Ongoing.
ERP-05D-S22	Llano Seco Ranch Acquired Conservation Easement on 4,235 acres of real property located in Butte County, CA	6/30/2006	\$2,570,000	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-05D-S29	Riparian Sanctuary (Phase II) – Bringing Agricultural and Ecological Interests Together for Pumping Plant Protection and Riparian Restoration (Sacramento River Mile 178) - Design Development and Environmental Compliance Planning and design efforts to develop second phase of multi-phase process to protect PCGID-PID's pumping plant and fish screen facility and to meet Sacramento River National Wildlife Refuge habitat goals for the Riparian Sanctuary.	6/30/2010	\$660,665	Ongoing.
ERP-05-S28	American Basin Working Landscapes Project Develops a GIS-based "working landscapes" model/plan for the American basin. Also, implement voluntary practices where appropriate, including easements, riparian restoration, wetland restoration, other on-farm, and farm-edge habitat restoration practices.	6/30/2010	\$1,860,898	Ongoing. Target of 400 acres of wildlife friendly agriculture, restored 28 acres of riparian vegetation and riverine corridors and 28 acres – natural wetland systems.
ERP-05-S33	Yolo-Solano Conservation Partnership for Habitat on Working Lands Developed collaborations to address restoration permitting needs, increase technical and economic incentives for farmers to increase habitat, conduct economic assessments. Project included riparian habitat enhancement.	9/10/2007	\$2,257,973	Complete.
ERP-06D-S15	Sacramento River Conservation Area Forum (SRCAF) Funds efforts of the Sacramento River Conservation Area Forum to act as a coordinating body between local, state, and federal agencies regarding restoration activities in the Sacramento River watershed.	3/31/2010	\$656,277	Ongoing.
ERP-95-M05	M&T/Parrott Pumping Station and Fish Screen Project This project involved relocation of M&T Ranches' Parrot-Phelan Pumping Station and implementation of fish screens on diversion structures to reduce fish entrainment on Big Chico Creek.	12/31/1997	\$1,610,000	Complete. Decommissioned old diversion (120 cfs) and relocated and constructed new diversion screened (150 cfs).
ERP-96-M03	Phase I of the Feasibility Study of the Lower Sacramento River Riparian Habitat Restoration Project Conducted a feasibility study to identify and design plans for potential sites to be revegetated to increase the amount of shaded riverine aquatic habitat along the lower Sacramento River. An important goal of this project was the evaluation of the impact that riparian habitat restoration has on both the Sacramento Flood Control System and the non-project levees in the Delta and adjoining areas.	9/14/1999	\$500,000	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-96-M06	Cosumnes River Watershed Project - Valensin Ranch Acquisition Acquired the Valensin ranch and included it in the Cosumnes River Preserve.	12/31/1996	\$1,500,000	Complete. Protected 500 acres of seasonal and permanent wetlands, 270 acres of mature, closed canopy valley oak forest and 60 acres of vernal pools.
ERP-96-M16	Sacramento River and Major Tributaries Corridor Mapping Project The California State University, Chico Geographic Information Center created a GIS package detailing riparian corridors along the Sacramento River and its major tributaries in portions of Glenn, Sutter, Colusa, Yuba, Yolo, and Sacramento Counties. Tasks include: 1) obtain infra-red and enlargement aerial photographs; 2) develop base-maps; 3) interpret vegetation and ground-truth; 4) digitize photo/vegetation information; 5) develop GIS files; and 6) complete the USVSCPP coverages.	12/31/1999	\$145,200	Complete.
ERP-96-M24	Butte Creek Watershed Management Strategy Created Butte Creek Watershed Management Strategy, which provides specific implementation actions aimed at maintaining a sustainable river ecosystem while addressing the concerns of local stakeholders.	12/31/1998	\$83,100	Complete.
ERP-96-M25	Battle Creek Watershed Management Strategy Formed a watershed conservancy and created a "community plan" for the Battle Creek watershed that supplemented the existing "technical plan" and provided a two-tiered document for restoration activities in the watershed based on collaboration between stakeholders.	10/15/1999	\$100,000	Complete.
ERP-96-M26	Prospect Island Monitoring Plan Project A monitoring plan to evaluate the biological, chemical and physical effects of the Prospect Island Restoration Project was developed under this contract. The monitoring plan evaluated the extent of benefits of conversion of agricultural land to shallow water tidal habitat to aquatic, terrestrial and avian species.	6/30/1998	\$35,000.00	Complete.
ERP-96-M27	Inventory of Rearing Habitat for Juvenile Salmon in the North Delta Project Inventoried rearing habitat for juvenile Chinook salmon and other native fishes in the northern Sacramento-San Joaquin Delta.	9/30/1998	\$24,500	Complete.
ERP-97-B04	San Joaquin River National Wildlife Refuge Riparian Habitat Protection and Floodplain Restoration Project - Phase I Acquired and planned restoration of additional floodplain lands for USFWS San Joaquin National Wildlife Refuge.	3/31/2002	\$10,947,000	Complete. Acquired 3,112 acres (in fee title) of San Joaquin River floodplain from 3 willing sellers on west side of river.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-B05	Feasibility Analysis for the San Joaquin-Bear Creek Floodplain Restoration Project, San Luis National Wildlife Refuge, Merced County Evaluated the benefits and impacts of allowing seasonal flooding onto refuge lands adjacent to Bear Creek. The purpose of this project is to restore unimpeded overflow to existing and future dedicated wetlands along the San Joaquin River system to the extent that impacts to adjacent lands and facilities can be mitigated and accepted.	9/30/2000	\$334,000	Complete.
ERP-97-C03	Upper Sacramento River Fisheries and Riparian Habitat Management Program (SB 1086) Implementation: Watershed Management Planning Developed a non-profit watershed group that will implement the goals of the Upper Sacramento River Fisheries and Riparian Habitat Management Program (SB1086) to improve riparian habitat along the Sacramento River.	12/31/2000	\$200,000	Complete.
ERP-97-C07	Preventing Exotic Introductions from Ballast Water Increased maritime industry members' awareness of ballast water release issues and alternative practices in order to reduce the introduction of nonnative species into the Delta.	8/31/2001	\$222,830	Complete.
ERP-97-C11	Spawning Gravel Introduction, Tuolumne River, La Grange Added 11,000 tons of gravel between the Old La Grange Bridge and Basso Bridge in the lower Tuolumne River in 1999 to increase and improve Chinook salmon spawning habitat.	12/31/2001	\$250,975	Complete.
ERP-97-E01	Watershed Management Strategy for the Big Chico Watershed Funded the creation of a Watershed Management Strategy for Big Chico Creek to serve as a tool for the protection and restoration of the watershed.	12/31/1999	\$422,830	Complete.
ERP-97-E02	Deer Creek Watershed Management/Implementation Program Supported on-going watershed monitoring and education programs in the Deer Creek watershed as directed by the Deer Creek Watershed Management Strategy, aimed at enhancing and improving stream habitat for anadromous fish and providing resources for implementation of restoration and monitoring activities in the watershed.	12/31/1999	\$196,554	Complete.
ERP-97-M08	Tuolumne River Channel Restoration (Pool 9) Filled mining pits and constructed setback levees in the Tuolumne River at river mile 25.9 to remove predator habitat and enhance riverine processes and salmonid habitats.	2/28/1999	\$2,253,100	Complete. Channel restored to 400 to 500-foot wide riparian flood plain. Rebuilt 1,200 foot long section of Tuolumne River.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-M09	Tuolumne River Setback: Dikes and Channel Restoration, Mining Reach 7/11 Segment Filled mining pits, removed dredger tailings, constructed setback levees, and restored the channel and floodplain in a 2.6-mile section of the Tuolumne River extensively mined for aggregate material. Other project funding is associated with ERP-98-F06.	2/31/2004	\$2,801,000	Complete. Constructed a series of setback levees along portions of the river adjacent to gravel mining operations RM 40.2 to 37.5 (2.6 mi). Revegetated 21.8 acres of riparian habitat.
ERP-97-N02	Sacramento River Floodplain Acquisition and Riparian Forest Restoration Increased the extent of channel meander and flood zones. Mapping of aquatic and terrestrial habitats. Increased native riparian growth and reduced exotic distribution adjacent to the river.	12/31/2002	\$9,905,438	Complete. Acquired 1,880 acres, Sacramento River Conservation Area between Keswick and Verona in Shasta, and Tehama, Butte, Glenn, Colusa, Sutter and Yolo Counties.
ERP-97-N03a	Ecosystem and Natural Process Restoration on the Sacramento River: Active Restoration of Riparian Forest The US Fish and Wildlife Service and The Nature Conservancy actively restored 200 acres of flood-prone agricultural lands to native riparian forest along the Sacramento River between Keswick and Verona. Restoration was conducted on 200 acres	6/20/2002	\$780,000	Complete. Converted 200 acres of agricultural land to riparian habitat. Keswick to Verona, river mile 215, S of Woodson Bridge.
ERP-97-N03b	Sacramento River Floodplain Acquisition and Riparian Forest Restoration The Wildlife Conservation Board/Dept. of Fish and Game actively restored 93 acres of flood-prone agriculture lands to native riparian forest along the Sacramento River between Keswick and Verona. This project increased shaded riverine aquatic habitat and improved degraded instream aquatic conditions. In addition, bird monitoring indicated the restored areas have dramatically improved existing riparian areas for bird usage.	11/1/2002	\$512,500	Complete. Beehive Bend (River mi 169.5), 65.5 acres restored/converted from agricultural land to riparian. Thomas Unit (River mile 166.5) 27.2 acres restored/converted from agricultural land to riparian.
ERP-97-N04	Sacramento River Meander Restoration Project acquired 94.55 acres of agricultural land and restored natural floodplain and river meander to the site. Goals include: Increase extent of channel meander and flood zones, mapping of aquatic and terrestrial habitats, increasing native riparian growth and reducing exotic distribution adjacent to the river.	2/25/2001	\$898,700	Complete. Restored a 10-acre portion of it to riparian habitat. The remaining acres can still be farmed at owner's risk. (Prune Orchard)
ERP-97-N05	Auburn River/Coon Creek Restoration Plan Developed Coordinated Resource Management Plans addressing the protection of habitat and improvement in water quality on the North and Middle Forks of the American River and the Auburn Ravine-Coon Creek watershed.	4/30/2002	\$222,530	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-N06	Butte Creek Riparian Protection and Restoration Project This project provides a portion of the funds for the acquisition of the McAmis Property, development of a management plan for the Ecological Preserve, and incorporation of the site into the Butte Creek Education Project.	12/31/2001	\$187,128	Complete. Acquired 93.40 acres of riparian.
ERP-97-N07	Cottonwood Creek Channel Restoration Planning/Geomorphic Analysis Geomorphic and hydrologic analyses and re-surveys of historic data to document geomorphic trends along lower Cottonwood Creek. Funded the initial phases for research, planning and design development for restoration of streambank habitat on lower Cottonwood Creek.	11/1/2002	\$61,000	Complete.
ERP-97-N08	Lower Mill Creek Riparian Restoration (Phase II) Restored and enhanced native riparian vegetation along Mill Creek, a high-priority tributary of the upper Sacramento River, for the benefit of anadromous fish.	6/20/2004	\$69,000	Complete. Acquired 9.48 acres of which 5 acres were restored to riparian.
ERP-97-N10	Restoring Ecosystem Integrity in the Northwestern Delta - Jepson Prairie Restoration and Habitat Conservation Plan Restored habitat along two northwest Delta sloughs and adjacent perennial grasslands at Jepson Prairie.	9/30/2002	\$292,801	Complete. Converted 507 acres of agricultural grazing land to perennial grassland. Fenced 500 ft along the bank of Calhoun Cut and planted native plants to restore riparian habitat and enhancing Delta Sloughs.
ERP-97-N12	Franks Tract State Recreation Area Wetlands Habitat Restoration Conducted planning and preliminary engineering for the restoration of deeply flooded habitat to 45 acres of tidal perennial aquatic, shaded riverine aquatic, and mid channel island shoal and shoal habitats in Frank's Tract State Recreation Area (SRA). The tasks included were permitting, environmental compliance, final design and other preconstruction planning.	12/31/2002	\$293,052	Complete.
ERP-97-N13	Tyler Island Levee Protection and Habitat Restoration Pilot Project Evaluated alternative vegetative and biotechnical techniques for stabilizing bank erosion restoring levees, as well as riparian and shallow water habitat.	5/31/2002	\$885,202	Complete. Georgiana Slough 0.85 miles and North Fork Mokelumne River 0.57 miles of biotechnical bank protection/creation of vegetation on top of riprap.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-N14	Cosumnes Start-up Stewardship and Restoration Acquisition and planning for 2,341 acres of floodplain properties consisting of various habitat types (agricultural land, dairy, oak woodland, grasslands, seasonal wetlands). Includes clean-up and repair of the properties.	9/30/2002	\$2,305,730	Complete.
ERP-98-A01	Prospect Island Habitat Protection Project Repaired levees and pumped out Prospect Island.	6/30/2000	\$2,000,000	Complete.
ERP-98-A02	Habitat Restoration/Flood Control Bypasses System Evaluated restoration needs and opportunities to improve habitat, reduce stranding and improve connectivity with the Sacramento River and the north Delta.	12/31/2002	\$947,2260	Complete.
ERP-98-B08	Cache Slough Shaded Riverine Aquatic Habitat Enhancement Project Planning phase of a project, which will restore approximately 2,000 LF of levee bank to shaded riverine aquatic habitat.	12/31/2001	\$85,000	Complete.
ERP-98-B10	Cat Creek Watershed Project, Review of the Forest Road System for Repair, Relocation or Obliteration Developed a watershed restoration plan to reduce erosion in the Cat Creek Watershed.	6/30/2000	\$38,000	Complete.
ERP-98-B14	Irrigation Drainage Water Treatment for Selenium Removal: Panoche Drainage District Demonstration Facility Demonstrated the effectiveness of microalgae as a substrate for nitrate and selenium reduction in agricultural discharge water. Evaluate treatment effectiveness, operational issues and estimate costs of process.	9/30/2002	\$1,171,956	Complete.
ERP-98-B17	Cosumnes Floodplain Acquisition and Restoration Restored and improved floodplain functions. Restored riparian and wetland vegetation.	12/31/1998	\$3,500,000	Complete.
ERP-98-B23	Steelhead and Chinook Salmon Fish Passage Barrier Remediation on the Guadalupe River Increased upstream passage of returning steelhead and Chinook salmon adults on the Guadalupe River by constructing fish passage structures past two diversion facilities.	8/31/2000	\$178,200	Complete. Stream length opened for passage 2.5 miles.
ERP-98-B32	Environmental Agriculture Conferences and Field Tours in the Agriculturally Impacted San Joaquin River Watershed Region Increased local growers, ranchers, agriculture advisors and agriculture industry-related business's awareness of issues involved in maintaining a functional river system.	12/31/2001	\$28,000	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-B33	Expand Bird Monitoring, Develop a Native Grass Plot, and Enhance Public Involvement with Access to Native Plant Garden Surrounding the Discovery Center Provided a public information/education component of CALFED work to ensure that the improvements on the river and the maintenance of a sustainable, balanced, healthy river system are understood and supported by the public.	9/30/2001	\$49,640	Complete.
ERP-98-B34	Discover the Flyway Increased student awareness of wetlands and wildlife issues in the Yolo Basin.	12/31/2001	\$49,000	Complete, enhanced seasonal wetland planting 3,000 native sedge/grass plugs
ERP-98-B35	The Butte Creek Watershed Educational Workshops and Field Tours Series Supported the efforts of the Butte Creek Watershed Project (BCWP) to create education workshops and outreach materials focused on watershed issues. This project would include 13 workshops/field tours to be held over the course of eighteen months.	12/31/2002	\$32,276	Complete.
ERP-98-B38	Water Hyacinth Education Program Distributed educational materials to Delta residents, which encourages waterway users to help achieve long-term control of hyacinth in the Delta region.	12/31/2001	\$9,598.00	Complete.
ERP-98-B39	Water Challenge 2010 Exhibit Traveling environmental exhibit titled "Water Challenge 2010", which increased public awareness, knowledge and appreciation of Bay-Delta natural resources.	12/31/2001	\$115,000	Complete.
ERP-98-B40	Increase Public Awareness of the Riparian Habitat and Ecosystems of the Tuolumne River Implemented educational programs to increase public knowledge and awareness of ecological issues and opportunities in Modesto, adjacent to the Tuolumne River.	12/31/2001	\$39,559	Complete.
ERP-98-C04/C05	Basso Bridge Ecological Reserve and Merced River Ranch Land Acquisitions Acquired 359.6 acres along the Merced River near Snelling, for the protection of riparian, wetland and riverine habitats.	12/31/2000	\$830,500	Complete. Acquired 359.6 acres, 1.5 miles along the Merced River.
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP Implementation of monitoring and applied research that provides data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-C17	Assist in Developing Appraisal & Planning with TNC for the McCormack-Williamson Property The California Department of Water Resources provided services and support for the acquisition and initial site planning for the McCormack-Williamson Tract, including an appraisal, a legal transaction review, and initial planning activities.	11/30/2001	\$24,000	Complete.
ERP-98-C19	Conduct/Facilitate Meetings on the Upper Yuba River, Engelbright Dam USFWS coordinated & facilitated meetings designed to gain agreement on the initial components of a study plan, to evaluate the feasibility of restoring anadromous fish runs above Engelbright Dam on the Yuba River.	12/30/1999	\$7,333	Complete.
ERP-98-E01	Napa River Watershed Stewardship Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/31/2000	\$250,000	Complete.
ERP-98-E03	San Francisco Bay Area Wetlands Ecosystem Goals Project Enabled the collection of data to be use in the creation of habitat goals to be used by private, local, state, and federal entities seeking to protect and improve the San Francisco Bay Area's wetlands.	3/31/1998	\$76,000	Complete.
ERP-98-E04	Petaluma River Watershed Restoration Program Implemented the restoration and monitoring projects identified in the Petaluma River Watershed Enhancement Plan with the goal of enhancing and restoring habitat and ecosystem function along the Petaluma River.	2/28/2001	\$220,000	Complete. Willowbrook/Lichau Creek reduced habitat fragmentation by reestablishing riparian vegetation along 3000ft of stream. San Antonio Creek stabilized 1000ft of streambank and planted native vegetation along 2000ft of streambank. Habitat restored saline emergent wetlands, riparian and riverine aquatic instream habitat (0.76 miles).
ERP-98-E05	Cottonwood Creek Watershed Group Formation Developed a comprehensive, community-based organization that will be able to develop and implement watershed stewardship strategies for the Cottonwood Creek watershed.	12/31/2001	\$161,000	Complete.
ERP-98-E06	Battle Creek Watershed Stewardship Facilitated the activities of the Battle Creek Watershed Conservancy in development and implementation of watershed restoration activities in the Battle Creek watershed.	9/15/2002	\$145,000	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-E07	Local Watershed Stewardship: Steelhead Trout Plan, Corte Madera Creek Watershed, Marin County, California Developed a steelhead restoration plan for the Corte Madera Creek as part of a larger watershed management plan for the Corte Madera Creek watershed.	12/31/2000	\$47,500	Complete.
ERP-98-E09	Merced River Corridor Restoration Plan - Phase II Analyzed and quantified current in-channel, riparian, and floodplain conditions in the Merced River Corridor.	3/23/2001	\$345,443	Complete.
ERP-98-E11	Watershed Restoration Strategy for the Yolo Bypass Facilitated broad based local stakeholder group in development of watershed plan.	3/31/2002	\$287,353	Complete.
ERP-98-E12	Lower Mokelumne River Watershed Stewardship Program (Phase I) Facilitated broad based local stakeholder group in development of watershed plan, develop Environmental Farm plan and expand Neotropical bird monitoring for the Mokelumne River Watershed.	9/1/2000	\$159,000	Complete.
ERP-98-E13	Union School Slough Watershed Improvement Program The Yolo RCD together with Audubon-California enacted portions of the 1996 Willow Slough Integrated Resources Management Plan, which Union School Slough is a part. This project developed California's first "service" to assist landowners with conservation practices and formed a landowner stewardship group for information sharing, problem solving, and "neighbor-convincing." Conservation activities included: 1) restoring upper watershed riparian areas and rangelands; 2) revegetating canals and drainage ditches; 3) constructing wildlife and tailwater ponds; and 4) restoring natural riparian function to the highly altered lower portion of the slough.	4/10/2002	\$636,000	Complete. Multiple habitats (including agricultural land (grazing); riparian and riverine aquatic - riparian) protective fencing, revegetation, controlled burns, seeding and pond construction, over 1,190.7 acres.
ERP-98-E14	American River (North and Middle Forks) Integrated Watershed Plan and Stewardship Strategy Developed a Watershed Management Plan and Stewardship Strategy to address a wide range of environmental, institutional, social, and economic issues for the watershed encompassing the North and Middle Forks of the American River.	12/31/2002	\$220,750	Complete.
ERP-98-E15	Sulphur Creek Coordinated Resource Management Planning Group Supported the ongoing efforts of the Sulphur Creek Coordinated Resources Management Planning Group, which is a broad based local stakeholder group that works to implement restoration activities in the watershed.	5/10/2001	\$23,828	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-E16	Lower Putah Creek Watershed Stewardship Program Developed a community-based watershed stewardship program from lower Putah Creek through a collaborative process involving stakeholders, landowners, state and federal resources agencies, and local groups.	3/31/2002	\$100,500	Complete.
ERP-98-E17	Alhambra Creek Watershed CRMP Program Developed a watershed management plan for the Alhambra Creek Watershed Plan using the Coordinated Resource Management Planning (CRMP) process. Also completed a Quality Assurance Project Plan (QAPP); A Users Manual; and Established Watershed Planning Group for public outreach.	4/30/2001	\$138,500	Complete.
ERP-98-F01	Butte Creek Watershed Coordinator Assistant, Education Project, Road Survey Project, Geomorphology Analysis, and Restoration Implementation Combined the tasks from four proposals submitted during the 1997 PSP year; 1) provided funds for an assistant watershed coordinator, 2) developed the Butte Creek Watershed Education Project, 3) funded the Butte Creek Watershed Road Survey, and 4) provided for a Geomorphology Analysis of Lower Butte Creek.	12/30/2001	\$302,745	Complete.
ERP-98-F03	Butte Creek Acquisition and Riparian Restoration Acquired and restored riverine habitat adjacent to spawning and holding pools in Butte Creek to provide an opportunity to develop and demonstrate methods of channel and floodplain management that would help stabilize the sediment from the remains of the gravel mining operations.	1/11/2002	\$186,128	Complete. Acquired and conducted planning for stream length 93 acres/0.75 miles (Butte Creek Ecological Preserve, Honey Run Unit). Habitats: riparian, wet meadow, annual grassland, gray pine, SRA, oak woodlands
ERP-98-F04	Lower Mill Creek Riparian Restoration (Phase II) Phase II of the Mill Creek Riparian Restoration Project. Restored and enhanced native riparian vegetation on one or more parcels along lower Mill Creek.	8/8/2001	\$30,000	Complete. Enhancement: planting, controlling invasive species and monitoring.
ERP-98-F06	Tuolumne River Floodway Emergency Repair and Long-Term Habitat Restoration Project (7/11) Filled mining pits, removed dredger tailings, constructed setback levees, and restored the channel and floodplain in a 2.6-mile section of the Tuolumne River extensively mined for aggregate material.	6/30/2004	\$1,358,846	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-F07	Grayson River Ranch Perpetual Conservation Easement and Restoration Provided a perpetual conservation easement on 140 acres, returning historic floodplain to the river, restoring critical riparian habitat, and providing greater flexibility with flood management.	10/31/2007	\$582,000	Complete. Also restored 26.5 acres to riparian and riverine aquatic – riparian habitat.
ERP-98-F09	Rhode Island Floodplain Management and Habitat Restoration - Phase I Evaluated floodplain and SRA habitat within/adjacent to Rhode Island in the eastern Delta for restoring and improve floodplain functions and shallow water and riparian habitat.	6/30/2000	\$25,000	Complete.
ERP-98-F11	Merced River Salmon Habitat Enhancement - Phase III (Robinson Reach) Eliminated predator habitat. Improved spawning and rearing habitat. Replanted riparian vegetation. Restored natural conditions to Merced River habitat at river miles 42 to 43.5. Filled/isolating deep pools, reconfigured channel and floodplain characteristics, and increased riparian habitat.	9/30/2002	\$2,433,000	Complete.
ERP-98-F12	Stone Lakes NWR Land Acquisition Acquired fee title to 537.35 acres of land within the boundary of the Stone Lakes National Wildlife Refuge to protect existing aquatic, wetland, and riparian habitats and restored a mosaic of aquatic, perennial and seasonal emergent wetland, riparian, and grassland habitats.	9/30/2003	\$2,626,505	Complete.
ERP-98-F15	Lower Clear Creek Floodway Restoration Project (Phase II) Improved salmon spawning and rearing habitat by implementing the Lower Clear Creek Watershed Management Plan and restoring 2.9 miles of floodplain and riverine aquatic habitat.	6/30/2006	\$4,561,940	Complete. Reported 35.9 acres restored to riparian. 1997-2000 annual gravel augmentation 24,000 tons.
ERP-98-F16	Fern-Headreach Tidal Perennial Aquatic and Shaded River Aquatic Conservation Project Acquired permanent conservation easement for Fern-Headreach Island Complex on 168 acres along the main channel of the San Joaquin River in the Delta.	6/30/2000	\$425,000	Complete. Acquired 28 acres of shaded riverine aquatic habitat and 140 acres of shallow freshwater tidal perennial aquatic habitat
ERP-98-F18	Floodplain Acquisition, Management, and Monitoring on the Sacramento River Acquired (via title or easement) flood-prone lands adjacent to the Sacramento River between Keswick and Verona with the purpose of protecting and improving essential spawning, rearing, and migratory habitat for Chinook salmon and other riparian species, as well as supporting the river's natural ecological processes.	9/30/2002	\$1,000,000	Complete. Acquired 106 acres.
ERP-98-F19	Cosumnes River Floodplain Acquisition, Restoration Planning, and Demonstration Along with ERP-N14, funded acquisition of Denier property.	9/30/2001	\$750,000	Complete. Acquired 475 acres of agricultural land.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-F20	Deer and Mill Creeks Acquisition and Enhancement Acquired and restored almost 2,500 acres of critical riparian and floodplain habitat along the lower and middle reaches of Deer and Mill Creeks in the upper Sacramento River watershed for the benefit of wildlife.	12/31/2003	\$1,000,000	Complete. Only reported 12 acres acquired.
ERP-98-F21	Lower San Joaquin River Floodplain Protection and Restoration Project Protected floodplain habitats. Implemented the acquisition of the Arambel and Rose property. Acquired 223.54 acres of wildlife habitat. Associated with an acquisition for the San Joaquin National Wildlife Refuge.	9/30/2002	\$1,100,000	Complete.
ERP-98-F24	Butte Creek Riparian Restoration Demonstration Restored the Virgin Valley Ecological Preserve by eliminating unauthorized vehicle access, providing over 6000 feet of walking trails, restoring damaged areas, and providing educational materials and signage at the site.	9/30/2002	\$76,348	Complete. Enhanced habitat by planting willows on top of riprap, 0.05 miles of stream length.
ERP-99-B04	Preliminary Design and Engineering of Lower Western Stone Site, Merced River Salmon Habitat Enhancement Project (Phase IV) Reduced entrainment of outmigrating fish. Improved river and floodplain dynamics and enhanced the riparian corridor.	4/30/2003	\$125,000	Complete.
ERP-99-B05	Merced River Salmon Habitat Enhancement Project Phase II- Ratzlaff Reach Construction) Reduced entrainment and predation of out migrating fish. Isolated 45 acres of unnatural predator habitat from the river channel. Improved river and floodplains dynamics and enhanced the riparian corridor. Increased the quantity and quality of in stream spawning.	3/30/2000	\$1,584,002	Complete. Reconstructed berms to isolate 45 acres of ponds from river. 3,000 ft (0.6 miles) of channel modified, 7,000 sq ft of spawning habitat will be created.
ERP-99-B12	Riparian Corridor Acquisition & Restoration Assessment Project Protected critical habitat through conservation easements and fee title acquisitions, and provided a foundation for ecosystem restoration specific to the project area. Approximately five miles of Sacramento River frontage, 4.5 miles of Battle Creek frontage, and 3 miles of Sacramento River (river mile 271-274) frontage preserved. Acquisition and assessment only.	4/30/2003	\$2,052,237	Complete. Protected 3 miles of riparian and 1,412 acres of multiple habitats along the Sacramento River. Protected 4.5 miles of riparian and 100 acres of multiple habitats along Battle Creek.
ERP-99-B20	Expand Bird Monitoring, Develop a Native Grass Plot, and Enhance Public Involvement with Access to Native Plant Garden Surrounding the Discovery Center Supported on-going educational programs at the Sacramento River Discovery Center that teach students about the complexities of watersheds and the importance of building partnerships to best manage these resources.	9/30/2001	\$38,400	Complete. Bird monitoring, volunteer recruitment, native grass plot study, and enhanced public involvement.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-B21	Estuary Action Challenge Environmental Education Project Funded educational outreach activities for the Estuary Action Challenge (EAC) program, enabling the EAC to promote environmental awareness of habitat restoration, pollution prevention, and safe bay food consumption through implementation and continued support of several outreach programs in collaboration with area teachers and students.	9/30/2000	\$50,000	Complete.
ERP-99-B22	Water Challenge 2010 Exhibit An interactive, hands-on environmental education exhibit.	6/30/2002	\$87,500	Complete.
ERP-99-B23	The Learning Watershed Project Supported the ongoing efforts of the American River Watershed Institute to implement a Learning Watershed Project that serves to educate and reach out to the public about important watershed issues.	9/30/2002	\$45,574	Complete.
ERP-99-B27	Watershed Educational Training (WET) Program Increased public awareness of watershed issues through implementation of the Colusa County Resource Conservation District's (CCRCD) Watershed Educational Training (WET) project, which linked community watershed health with the ecological objectives and goals identified by the CBDA.	6/30/2003	\$12,887	Complete. The educational projects reached approximately 61,365 people.
ERP-99-B29	Pilot Project to Benefit Riparian Vegetation Along the San Joaquin River Monitored the downstream effects of the augmented flows at ten recommended cross sections, including the response of riparian seedlings and saplings on the San Joaquin River. This pilot project released 35,000 acre-feet of water during the period of June	12/31/2001	\$2,500,000	Complete.
ERP-99-C01/C02	East Delta Corridor Habitat Studies: Cosumnes and Mokelumne Rivers Feasibility Study Feasibility Study of Ecosystem Restoration opportunities on the lower Cosumnes and Mokelumne Rivers.	6/30/2007	\$1,007,800	Complete.
ERP-99-F01	Tuolumne River Special Run Pool 10 (levee repair and monitoring) Repaired a dike at an off-channel mine pit in the lower Tuolumne River to reduce predation on juvenile Chinook salmon.	3/31/2006	\$164,800	Complete.
ERP-99-F02	Tuolumne River Mining Reach Restoration (MJ Ruddy) Reconstructed 1.1 miles of the lower Tuolumne River channel and floodplain that was previously diked for gravel mining and then destroyed by the January 1997 floods for the primary benefit of San Joaquin fall-run Chinook salmon.	3/31/2006	\$168,813	Complete. Restored a 1.1 mi reach of river to a more natural channel by creating a 500 ft wide floodplain and repaired 100 ft of berm breached in 1997 flood.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-F03	Part B: The McCormack-Williamson Tract's Wildlife-Friendly Levee Management Project On the purchased McCormack-Williamson Tract (99-F04), The Nature Conservancy initiated startup stewardship, coordinated with agencies for restoration planning, and implemented a wildlife-friendly levee program.	12/31/2004	\$860,778	Complete.
ERP-99-F04	Part A: The McCormack-Williamson Tract Acquisition Acquired the McCormack-Williamson Tract.	12/31/2004	\$5,356,000	Complete. 1,512 acres acquired in multiple habitats.
ERP-99-F08	Purple Loosestrife Prevention, Detection & Control in the Sac/SJ Delta & Associated Hydrologic Units Over a 3 year period, the Integrated Pest Control Branch of the CA Dept of Food & Ag carried out a series of tasks which resulted in: 1. an exhaustive survey of the Sacramento-San Joaquin Delta; 2. local eradication of loosestrife in Phase I and II areas; 3. focused delimitation and survey of all loosestrife infestations in the CALFED focus area; 4. training of agency personnel, working in and near the Delta, to recognize purple loosestrife and other aquatic non-native invasive species; and 5. education of the boating, water fowl hunting, and similar public citizenry. Project is tied to ERP-99-N11 and ERP-99-N11b.	5/31/2003	\$221,306	Complete.
ERP-99-N03	East Delta Habitat Corridor, Tidal Marsh and Riparian Habitat Restoration Tidal marsh and riparian restoration project which improved habitat conditions along 14 miles of Georgiana Slough.	9/30/2003	\$1,100,000	Complete. Enhanced 0.57 stream miles of tidal perennial aquatic, and 7 stream miles of riparian, and finally protected an additional 1.5 stream miles of riparian.
ERP-99-N04	Lake Red Bluff Riparian Area Restoration and Education Support Project Restored 2 acres of riparian habitat in the Lake Red Bluff Riparian Area on the mainstem of the Sacramento River by removing invasive exotic plant species, reintroducing native species, and reducing erosion.	3/27/2003	\$29,114	Complete.
ERP-99-N08	Assessment of Pesticide Effects on Fish and their Food Resources in the Sacramento-San Joaquin Delta An integrated laboratory and field study with the objectives of providing information on pesticide toxicity to resident species in the Sacramento-San Joaquin Delta, developing the data needed to apply laboratory-derived toxicity measures to realistic field conditions, and putting results in an ecological context focusing on juvenile Chinook salmon and their prey.	8/01/2004	\$1,706,670	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-N11	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Surveyed and mapped the non-native invasive plant species, purple loosestrife. Developed a site-specific adaptive management plan and comprehensive local eradication and control efforts.	1/10/2003	\$139,473	Complete.
ERP-99-N11b	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units Continued early detection, prevention and eradication/control work for purple loosestrife in the Phase I and Phase II areas (these phases were funded to ERP-99-N11 and ERP-99-F08).	12/31/2003	\$49,865	Complete.
ERP-99-N14	Colusa Basin Watershed Project A watershed management project to assist private landowners in addressing non-point source pollution, flood control issues, exotic invasive weed abatement, and reactivating important ecological processes and functions of riparian corridors in the Colusa Basin Drain watershed.	11/6/2005	\$492,500	Complete. Created ponds, planted riparian areas, provided exclusion fencing, irrigation systems, halting erosion.
ERP-99-N15	Lower Mokelumne River Watershed Stewardship Plan Program (Phase II/III) Continuation of a previously funded project by completing preparation of the Lower Mokelumne River Watershed Stewardship Plan/Watershed Owner's Manual, Action Plan, and Monitoring and Evaluation Program and implemented the Initial Watershed Stewardship Actions.	06/30/2002	\$227,000	Complete.
ERP-99-N16	Clear Creek Prescription Created an ecosystem-based watershed management prescription for the Clear Creek watershed to 1) help achieve CBDA's vision of restoring important fishery, wildlife, and plant communities to a healthy condition, and 2) serve as a model for other watersheds in the state.	5/31/2003	\$256,260	Complete. Treated 3 fuel break sites and 2 erosion sites, 3 culverts were replaced, and 200 ft of road out sloped to address erosion, sediment sources, and fire protection in upper watershed (36 acres enhanced total).
ERP-99-N17	Yuba Watershed Council: A Collaborative Approach Supported the ongoing efforts of the Yuba Watershed Council (YWC) by funding a watershed coordinator, materials, equipment, and office space to provide coordination and assistance, adaptive management and monitoring, education and outreach, and continuity and program oversight of current and future watershed projects.	6/30/2003	\$142,618	Complete.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-N18	Geomorphic Model for Demonstration and Feasibility Assessment of Setback Levees: Bay-Delta River Systems Developed a geomorphic model that allows simulation and demonstration of the response of riverine systems to levee removal and setback. Developed levee and infrastructure-placements component of this migration model; applied the model to simulate levee setback scenarios; developed interactive computer visualization of model output; and prepared model simulations, report and recommendations.	6/11/2004	\$104,458	Complete.
ERP-99-N19	American River (South and Middle Fork) Watershed Stewardship Project Produced a Watershed Management Plan and Stewardship Strategy for the South and Middle Forks of the American River to serve as a tool for implementing restoration activities on the river.	5/15/2004	\$253,738	Complete.
ERP-99-N20	Napa River Watershed Stewardship Year 2 Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/30/2001	\$191,100	Complete. Hydrologic modeling. Multiple habitats enhanced. Eroding bank stabilization, Himalayan blackberry eradication, riparian enhancement and revegetation, spawning habitat improvement (0.05 stream miles, 0.25 acres).
ERP-99-N21	Development of a River corridor Management Plan for the Lower American River Developed a River Corridor Management Plan (RCMP) for the lower American River between the Sacramento River and the Nimbus Dam in Sacramento County to serve as a planning framework and consensus-building process for pursuing CALFED's vision and objective for ecosystem restoration along the American River.	4/1/2002	\$250,000	Complete.
ERP-99-R01	NRCS Floodplain Easements; Lower Tuolumne and San Joaquin Rivers Acquired and restored area prone to flood damage. Monitored vegetation and wildlife populations. [Floodplain Easements; Lower Tuolumne and San Joaquin (DA9)]	3/31/2001	\$1,412,108	Complete. NCRS acquired perpetual floodplain easements, 1,073 acres.

Table 2. Riparian and Riverine Aquatic Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
IMM-02-101	Battle Creek Protection and Stewardship Purchased conservation easements, fenced and restoration of creek sides and other sensitive habitats, and monitored habitat on three ranches in the Battle Creek watershed.	Unknown	\$2,206,625	Ongoing. Contracted to acquire by conservation easement Lazy R Bahr Ranch (3,000 acres, 2 stream miles) and Wildcat Ranch (1,844 acres, 2-stream miles). Reported acquisition of McCampbell Ranch (2,007 acres, 2 stream miles). Multiple habitats including riparian listed for each property.

Other Programs Contributing to ERP Vision

Many researchers looking at various habitat features have revealed the extent to which we can successfully restore riparian habitat and riverine aquatic habitat. California State University, Chico conducted a study to compare leaf litter decomposition rates in restored riparian forests to those in mature, naturally established riparian forests (Borders et al. 2006). Results suggest that a functionally equivalent process of leaf litter decomposition occurs in both restored and naturally established forests and therefore shows promise for measuring the efficiency of nutrient cycling processes in these restored forests.

The CALFED Science Program funded research which compared plant community composition and structure in 25 remnant riparian forest plots to that of 27 plots in established restoration (seven years old or older) along the Middle Sacramento River (Wood and Little 2007). The restoration plots compared favorably to remnant plots. Remnant plots had slightly lower mean species richness (19.8 vs. 22.6), slightly higher mean percent native species (63.7% vs. 53.8%), and significantly higher mean stem basal area (175.4 vs. 76.6) (Wood and Little 2007). As would be expected, remnant plots were found to have large trees and occur in frequently flooded areas, whereas restoration plots tended to have multi-stemmed shrubs, small trees, and occur in both low-lying and higher terrace locations. These findings indicated that restoration revegetation should reach the intended condition once the trees reach full size, and if exotic species are controlled.

Riparian restoration projects restore non-target species. Neal Williams, Assistant Professor of Biology at Bryn Mawr College, investigated bee and flowering plant communities at six restored sites and riparian remnants between Red Bluff and Colusa (Williams 2007). Average richness and abundance did not differ between sites types, indicating that restored habitats supported abundant and diverse pollinator communities

within five to ten years after planting. However, the composition of bee communities at restored sites differed significantly from those in remnants. The results suggested that many species found at restored sites arrived from habitats other than forests. There was a distinct difference between the flowering plants found at restored compared to remnant sites, which may contribute to the differences in pollinator communities (Williams 2007).

TNC's Sacramento River Project and a Research and Creativity grant from California State University Chico funded a study that compared of surface-active beetle (Coleoptera) assemblages in remnant and restored riparian forests of varying ages on the Middle Sacramento River. This research found that surface-active beetles are good indicators of habitat change in riparian restoration (Hunt 2007). Several morphospecies were significantly associated with each forest type, some appearing restricted to either remnant riparian forests or young restoration sites. Analyses indicate that as restoration sites age, their assemblages increasingly resembled those found in remnant riparian forests (Hunt 2007).

Yangdong Pan, Assistant Professor at Portland State University, investigated the utility of monitoring benthic diatom assemblages to explain riparian conditions. They found *Staurosira construens* (11%), *Epithemia sorex* (8%), *Cocconeis placentula* (7%), and *Nitzschia amphibia* (6%) dominated the assemblages. Multivariate analyses showed that channel morphology, in-stream habitat, and riparian conditions mainly affect benthic diatom assemblages, which suggests that benthic diatoms can be used for assessing physical habitat alterations in streams (Pan et al. 2006).

Stacy Small, a graduate student at University of Missouri-Columbia, provided further evidence that riparian restoration projects on the Sacramento River Valley are restoring habitat to a level equivalent to remnant riparian habitat. Small (2007) found no difference in nest predation rates on restoration and mature remnant forest sites. Nest predation, in addition to nest parasitism, by the Brown-headed Cowbird (*Molothrus ater*) may be a critical limiting factor for Spotted Towhees (*Pipilo maculatus*) (Small, 2007). Small (2007) also found that flood timing influences nest predation rates for Black-headed Grosbeaks (*Pheucticus melanocephalus*), possibly by driving mammalian nest predator population cycles.

TNC funded research that examined local landowners, concerns regarding riparian restoration contributing to pest populations and resulting in crop damage. Golet et al. (2007) studied small mammal distribution and abundance at four habitat types (agricultural, young restoration, older restoration, and remnant riparian) on the middle Sacramento River. They found that although certain orchard pests (especially voles) had relatively high abundances at young restoration sites, these declined as sites matured. Overall, relative abundance of small mammal pests was typically lower in older restoration sites and remnant habitats than in agricultural sites. In young restoration sites, voles could be controlled by erecting Barn Owl nest boxes, as voles

are their most common prey. A conservation concern was the high relative abundance of exotic black rats (*Rattus rattus*), a predator of songbird nests and roosting bats, in older restoration sites and remnant riparian forests (Golet et al. 2007).

The DFG has created a vegetation classification system for the Delta, Suisun Bay, and Suisun Marsh that can be used as a basis for conservation actions for riparian and riverine aquatic habitat (Hickson and Keeler-Wolf 2007, Keeler-Wolf and Vaghti 2000).

Department of Water Resources (DWR) completed the vegetation mapping portion of the Stage 1 expectation for the main stem of the San Joaquin River (RM 267 to RM 118). DWR identified, described and mapped the extent and diversity of riparian habitats found along the main stem of the San Joaquin River, to help develop a map of restoration potential along the river (Moise and Hendrickson 2002). Vegetation was classified using a modified Holland system (Holland 1986). Eleven basic vegetation communities were found along the San Joaquin. Such GIS layers as: vegetation/land use, weedy invasives, corridor width (distance between confining levees or bluffs), and georectified aerial photography were created. Of 59,941 acres of riparian corridor and floodplain mapped, about half is native or naturalized vegetation; while the remainder is urban, disturbed, cultivated, or open water (Moise and Hendrickson 2002). Overall cover of woody vegetation (forests, woodlands, and scrubs) is approximately 25% of the total natural vegetation mapped. Of this, a mere 3,809 acres is actually riparian forest (Moise and Hendrickson 2002). The majority of the remaining acreage is covered by herbaceous vegetation (Moise and Hendrickson 2002).

There is debate on how to map riparian habitat. In a project conducted for the California Riparian Habitat Joint Venture (RHJV), Collins et al. (2006) compared and contrasted definitions and methods of mapping existing and potential riparian areas throughout California. Six methods for mapping existing riparian habitat were developed using combinations of rules supported by the scientific literature. These methods range from just mapping what is obviously riparian vegetation (Method 1), to accounting for the effects of vegetation height and topography on the width of riparian areas for broad suites of riparian functions (Method 6). Four methods of mapping potential riparian habitat were also compared. These methods range from simply adopting the FEMA 100-yr flood hazard maps (Method 7) to predictive maps based on regional relationships between fluvial channel geometry and drainage area (Method 10). See Collins et al. (2006) for complete description of methods. Based on their accuracy and cost, Method 6 for mapping existing riparian areas and Method 10 for mapping potential areas seem optimal (Collins et al. 2006). Method 10 needs further development, however, to work well in all settings. Method 6 is best at identifying the full extent of riparian form and function. It can be standardized throughout California by many work centers using existing data. Given that the RHJV definition of riparian habitat is not yet widely recognized in California, they recommend that further analyses of its ramifications for existing state environmental policies and programs be encouraged. This report can help inform those analyses by showing how different

mapping methods translate the definition into measures of the existing and potential extent of riparian resources. Collins et al. (2006) also recommend that this report be published through formal peer review to further establish its scientific credibility. Finally, they noted that one or more of the methods discussed in this report will be used in the existing State Wetland Demonstration Project (WDP) of the Resources Agency and related projects funded through the State Coastal Non-point Source Program during 2007-09.

Other researchers have developed assessment tools (e.g. NetMap) for watershed and resource management. NetMap, developed by Earth Systems Institute, consists of digital watershed databases (25 base parameters) and 30 automated GIS tools, defines: 1) erosion potential, delivery, and significance; 2) aquatic habitat quality, distribution, and sensitivity; 3) instream wood accumulation; and 4) habitat diversity and core areas, among other facets. Search functions identify overlaps between specific hillslope and channel conditions and between roads and habitat or erosion potential. The recent application of NetMap to two million acres of the upper Sacramento and Trinity River basins provides users the ability to create watershed contexts for restoration projects. A watershed context supports prioritization of 1) habitat suitability; 2) critical riparian zones; 3) habitat diversity; and 4) erosion and sediment delivery potential (hillsides and roads) (Benda and Andras 2007).

Another analysis tool has been developed by TNC to aid their staff in the preliminary site planning process by prioritizing parcels for protection. The tool, dubbed 'The Parcel Picker', is a spatially-enabled extension for the ArcGIS ArcMap application. The extension utilizes a spatial analysis technique commonly referred to as a Weighted Linear Combination, where various factor maps are weighted and combined to produce a relative suitability score. Individual parcels can then be assigned a single suitability score. Users can choose inputs from the provided list of factors, all related in some manner to targets and threats, and produce an output map of priority areas based on a subjective assignment of weights. This process can be performed multiple times using various weighting schemes, thus allowing evaluation of the effects of different combinations of factors and weights. An important component of the model is that full documentation is written into the output itself which describes the data and weighting scheme used. Because the model is based on user-defined values and accepts an array of input datasets, the tool can be used across multiple regions (Galang 2007).

In contrast to the monitoring mentioned above, most projects have not been mapped or monitored as to their contribution to CALFED goals and objectives, etc. However, the lack of monitoring is not unusual for river and stream restoration projects in North America, since 1990 only 10% have been monitored for biological function, although habitat improvement is the goal of many projects (Small 2007). As part of the National River Restoration Science Synthesis (NRRSS), Kondolf et al. (2007) developed a summary database of 4,023 stream restoration projects built in California since 1980, from which we randomly selected 44 records for in-depth interviews with project

managers learn about current design, implementation, monitoring, and evaluation practices used. Although more than half of the projects for which the authors conducted interviews were located in watersheds for which a management or assessment plan had been prepared, these plans had a limited impact on site selection. Furthermore, they found that the state lacks a consistent framework for design, monitoring, and reporting restoration projects, and that although monitoring is far more widespread than the information in the NRRSS summary database would suggest, there are still problems with the type, duration, and reporting of monitoring. The general lack of systematic, objective assessment of completed projects hinders the advance of restoration science (Kondolf et al. 2007). Although there is probably more monitoring associated with ERP projects, these findings still basically apply to projects undertaken by the program.

Status of Topic Today

ERP completed, to various degrees in each region, a classification system for riverine and riparian habitats that can be used as a basis for conservation actions. ERP completed inventories of habitat types for the Suisun Marsh, the Delta, and the main stems of the Sacramento and San Joaquin Rivers, including many of their tributaries. However, it is not clear to what extent prioritization of conservation actions have been made. There were efforts to prioritize conservation actions along the San Joaquin and Sacramento Rivers. It is apparent that restoration actions have been evaluated in many locations and initiated where feasible. However, the problems with reporting and monitoring still hamper the clear assessment of ERP's progress toward achieving goals, objectives, and targets.

Planned Projects for Implementation

Dutch Slough Tidal Marsh Restoration Project (ERP-02-C07-D) estimates that it can restore up to 197 acres of Mixed Riparian-Oak Woodland. The Dutch Slough site was acquired by DWR in 2003. DWR and its partners have completed a restoration plan that is designed both to restore habitat and generate information about how best to restore Delta habitat in the future. The project is ready for implementation.

Full implementation of *Northwestern Delta - Jepson Prairie Restoration Phase II (ERP-02D-P54 and ERP-02-P21)* would acquire conservation easements on 1,100 acres of existing riparian, wetland and/or agricultural lands.

Feasible management options have been identified for the Riparian Sanctuary at the Sacramento River National Wildlife Refuge, Llano Seco Unit. Implementation would improve habitat and ecosystem processes over 950 acres.

Hamilton City Flood Damage Reduction and Ecosystem Restoration Project (ERP-05D-C01) full implementation will restore up to 1,500 acres of riparian communities as well as construction of a 7 mile long setback levee.

With the completion of *Sub-Reach Planning for the Sacramento River: River Mile 144-164 (ERP-02-P27)* in April 2008, acquisition and restoration should begin on the Colusa-Princeton Sub-reach of the Sacramento River (RM 144-164).

Impediments to Implementation

Impediments to making further gains come primarily from conflicts or concerns posed by landowners and adjacent landowners. Tension between agricultural landowners and restorationists along the Sacramento River due to the conversion of farmland to riparian forest and other habitat types has been caused by the perception of the increase in exposure to negative biological and physical impacts on farming and the environment, such as floods and wildlife (Singh 2007). Some local agricultural landowners have created political opposition to the increase in riparian habitat within the Sacramento River Conservation Area. The Glenn County Resource Conservation District looked at an environmental conflict management process to reduce tension between stakeholders along the Sacramento River by applying the use of environmental history and stakeholder interviews and surveys to describe the evolution of, and reasons contributing to, the conflict (Singh 2007). The study constructed a theoretical model of an ecological commons to describe the political and environmental interactions that contribute to the conflict as well as the difficulty in managing conflict along the Sacramento River.

The issue of riparian areas harboring agricultural pests was examined by Golet et al. (2007). Farmers are concerned that riparian areas harbor agricultural pests at least at levels higher than would be in the absence of adjacent riparian vegetation, however as mentioned previously, relative abundance of small mammal pests was found to be typically lower in older restoration sites and remnant habitats than in agricultural sites (Golet et al. 2007).

Gaining and maintaining public support is important to the future of ecosystem restoration of riparian systems. In addition to the values of biodiversity and healthy natural systems, large segments of the public look for specific benefits that affect their everyday lifestyle, such as recreation opportunities (Werner et al. 2007). TNC in partnership with EDAW developed two public recreation plans that were tied to the conservation of riparian habitat in Colusa County. Through an intensive public engagement process, local consensus on these plans was achieved in an area which has not traditionally supported of ecosystem restoration efforts (Werner et al. 2007).

Another impediment to protecting or increase riparian habitat is flood control and bank armoring (riprap) projects. Levee, bridge, and bank-protection structures are present along more than 2,600 miles of rivers in the Central Valley and in the Delta (DWR 2005). These projects work against the natural meander process of the rivers and furthermore cut off riparian habitat from the rivers which they are associated. Plans for new bank protection projects continue to be developed and if implemented, would further reduce available habitat.

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4. HABITAT

4.9 Freshwater Fish Habitat

Introduction

Freshwater fish habitats and native fishes are closely linked in the Central Valley, and the health of native fish populations is largely dependent on the health of their habitats. The Sacramento-San Joaquin drainage system's large size, diversity of aquatic habitats, and isolation from other systems, has provided a basis for freshwater fish speciation. The diversity of habitats supports a variety of native resident fish species, native anadromous species, native marine species, and an ever-increasing number of introduced species.

The major classifications of Freshwater Fish Habitats in the Central Valley include standing water, flowing waters and artificial habitats (CALFED 2000a). Standing water includes ephemeral waters such as floodplain and vernal pools, and permanent waters such as lakes, sloughs, oxbow lakes, and backwaters. Flowing water fish habitats include resident trout streams, salmon-steelhead streams, and low elevation streams, which include the main channels of the Sacramento and San Joaquin rivers, and the lower reaches of their tributary streams. Artificial habitats include: ephemeral water such as rice paddies, managed waters in wildlife refuges, drainage and evaporation ponds, and seasonally irrigated lands; permanent waters such as cold and warm water ponds, ornamental ponds, various types of reservoirs, forebays, and flooded pit lakes such as gravel and rock quarries; and flowing waters such as aqueducts, drainage and irrigation ditches, and flood control canals and bypasses such as the Yolo Bypass. Due to the amount of water resource development in the Central Valley, these artificial habitats provide a significant amount of habitat in the area.

This section on Freshwater Fish Habitats complements other habitats described in this report, especially the following section titled 4.10 Essential Fish Habitats.

Applicable ERP Vision

The vision for freshwater fish habitat is to protect existing habitat from degradation or loss, to restore degraded habitats, and restore areas to a more natural state to assist in the recovery of special-status plant, fish and wildlife populations (CALFED 2000a). Specifically, freshwater fish habitat in the various regions will be maintained through actions directed at streamflows, coarse sediment supply, stream meander, natural floodplain and flood processes, and maintaining and restoring riparian and riverine aquatic habitats.

Stage 1 Expectations

The expectations for Stage 1 were that Freshwater Fish Habitat would be increased to assist in the recovery of special-status plant, fish, and wildlife populations. Restoration was to provide high-quality habitat for other fish and wildlife dependent on the Bay-Delta (CALFED 2000b). Within the San Joaquin Habitat Corridor, restoration was to provide a contiguous habitat corridor of tidal perennial aquatic habitat, freshwater fish habitat, essential fish habitat, and improved river-floodplain interactions.

Changes Attributable to ERP

All of the projects that benefited Freshwater Fish Habitat also benefited other ecosystem elements and were multi-objective. Projects are discussed in more detail within other element chapters within the report and EMZ chapters in Appendix A.

Ecosystem topic areas that projects targeted were: 1) At-Risk Species Assessment; 2) Ecosystem Water and Sediment Quality; 3) Environmental Education; 4) Environmental Water Management; 5) Estuary Foodweb Productivity; 6) Fish Passage; 7) Fish Screens; 8) Harvestable Species Assessment; 9) Hydrodynamics, Sediment Transport, and Flow Regimes; 10) Local Watershed Stewardship; 11) Lowland Floodplains and Bypasses; 12) Mine Remediation; 13) Non-Native Invasive Species; 14) Riparian Habitat; 15) River Channel Restoration; 16) Sediment Quality; 17) Shallow Water and Marsh Habitat; 18) Upland Habitat and Wildlife Friendly Agriculture; and 19) X2 Relationships (Freshwater-Seawater Interface).

Project Summary Table

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-B06	Biological Assessment of Green Sturgeon in the Sacramento-San Joaquin Watershed (Phase II) The green sturgeon is a California Bay-Delta Authority Priority Group I species, and this project focused on the biological characteristics of this species and its habitats towards their eventual restoration.	7/3/2002	\$205,013	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-C12	Technical/Scientific Review of Upper Yuba River Studies Program: Environmental Economics Expert Contractor provided technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program. As a member of the Technical Review Panel, the Contractor reviewed materials, attend workshops, participate in discussions, respond to inquiries and present findings and advice. A three-day workshop was held during September 2001 during which the technical details of the proposed work on the UYRSP was discussed.	6/30/2006	\$28,000	Complete.
ERP-01-C14	Technical/Scientific Review of Upper Yuba River Studies Program: Zoology Expert Contractor is to provide technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program. As a member of the Technical Review Panel, the Contractor will review materials, attend workshops, participate in discussions, respond to inquiries and present findings and advice. A three-day workshop will be held during September 2001 during which the technical details of the proposed work on the UYRSP will be discussed.	6/30/2006	\$28,000	Complete.
ERP-01-C16	Technical/Scientific Review of Upper Yuba River Studies Program: Marine Fisheries and Economics Expert Contractor provided technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program. As a member of the Technical Review Panel, the Contractor reviewed materials, attend workshops, participate in discussions, respond to inquiries and present findings and advice. A three-day workshop was held during September 2001 during which the technical details of the proposed work on the UYRSP was discussed.	6/30/2006	\$26,000	Complete.
ERP-02-P06	Kids for Our Creeks The goal of this environmental education proposal is to establish partnerships with the local K-8 schools and establish watershed education programs through the use of an education coordinator.	6/30/2007	\$164,579	Complete.
ERP-96-M27	Inventory of Rearing Habitat for Juvenile Salmon in the North Delta Project Inventory of rearing habitat for fisheries, including fisheries surveys. This project is an inventory of rearing habitat for juvenile Chinook salmon and other native fishes in the northern Sacramento-San Joaquin Delta.	9/30/1998	\$24,500	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-B01	Watershed Improvement: Stabilization of Potential Sediment Sources within the Deer, Mill, Antelope Creek Watersheds on Lassen National Forest Lands (Phase 1 of 2 Phases) This project will stabilize potential sediment sources within the Deer, Mill, and Antelope Creek watersheds on Lassen National Forest lands for the benefit of anadromous fish species.	3/31/2001	\$371,000	Complete.
ERP-98-C19	Conduct/Facilitate Meetings on the Upper Yuba River, Engelbright Dam FWS is to coordinate & facilitate meetings designed to gain agreement on the initial components of a study plan which will evaluate the feasibility of restoring anadromous fish runs above Engelbright Dam on the Yuba River.	6/30/1999	\$7,333	Complete.
ERP-98-E08	Cold Water Fisheries and Water Quality Element This project will provide watershed management tools for the Santa Clara Valley Basin with the primary goal of protecting and/or restoring streams, reservoirs, wetlands, and the South Bay for the benefit of fish, wildlife, and the community.	12/31/2002	\$200,000	Complete.
ERP-98-E17	Alhambra Creek Watershed CRMP Program Developed a watershed management plan for the Alhambra Creek Watershed Plan using the Coordinated Resource Management Planning (CRMP) process. Also completed a Quality Assurance Project Plan (QAPP); A Users Manual; and Established Watershed Planning Group for public outreach.	12/3/2001	\$138,500	Complete.
ERP-99-B09	Development of Implementation Plan for Lower Yuba River Anadromous Fish Habitat Restoration This project will develop an implementation plan and conduct modeling, public outreach, and local involvement plans, all of which are related to the Lower Yuba River Anadromous Fish Habitat Restoration Actions.	7/15/2003	\$171,100	Complete.
ERP-00-E03	Cottonwood Creek Watershed Monitoring and Assessment Continued management of the Cottonwood Creek Watershed Group to oversee the implementation of a watershed plan. This phase would assess current conditions in the watershed, both as to the land and stream conditions, and to give a baseline for future projects.	12/31/2003	\$350,000	Complete.
ERP-00-E05	Merced River Corridor Restoration Project - Phase III To develop a publicly supported, technically sound, and implementable restoration plan for the Merced River corridor from Crocker-Huffman Dam downstream to the San Joaquin River.	11/1/2002	\$341,271	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-F03	Floodplain Acquisition and Sub-reach/Site Specific Management Planning on the Sacramento River (Red Bluff to Colusa) Completion of this project will result in the acquisition of 9 parcels (1,733 acres) within the SB 1086 Sacramento River Conservation Area (Red Bluff to Colusa); baseline assessment/start-up stewardship for newly acquired parcels; site-specific management planning for the "Beehive Bend Subreach"; monitoring; and project management. This project is for planning purposes NOT acquisition.	9/30/2003	\$519,000	Ongoing.
ERP-00-F08	McCormack-Williamson Tract Restoration Planning, Design and Monitoring Program I This project will perform baseline studies necessary for project planning and design, and the development of long-term monitoring programs of the McCormack-Williamson Tract (M-W), which is a 1,600-acre Delta island.	8/1/2003	\$556,200	Complete.
ERP-01-C08-D	Technical and Scientific Services for the Upper Yuba River Studies Program USGS investigated water quality and sediment transport and yield in the Yuba River (Y.R.) watershed. The overall objective was to improve understanding of sediment supply, transport, and storage of sediment in the Yuba River watershed, and to improve understanding of the current level of mercury contamination of Engelbright Lake sediments and biota. An assessment of the transport of the existing sediment in the reservoir to the downstream reaches was performed following several potential management scenarios.	6/14/2005	\$534,000	Complete.
ERP-01-C10	Technical/Scientific Review of Upper Yuba River Studies Program: Ecotoxicology Expert Contractor is to provide technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program. As a member of the Technical Review Panel, the Contractor will review materials, attend workshops, participate in discussions, respond to inquiries and present findings and advice. A three-day workshop will be held during September 2001 during which the technical details of the proposed work on the UYRSP will be discussed.	6/30/2006	\$44,000	Complete.
ERP-01-C11	Technical/Scientific Review of Upper Yuba River Studies Program: Hydrotechnical Engineering Expert Contractor is to provide technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program. As a member of the Technical Review Panel, the Contractor will review materials, attend workshops, participate in discussions, respond to inquiries and present findings and advice. A three-day workshop will be held during September 2001 during which the technical details of the proposed work on the UYRSP will be discussed.	6/30/2006	\$28,000	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-N08	San Joaquin River NWR Riparian Habitat Protection & Floodplain Restoration Project - Phase II Fund easement acquisition. Restore riparian and wetland habitat. Reintroduce riparian brush rabbits. Monitor. Associated project (ERP-97-B04) for Phase I.	12/31/2006	\$7,968,112	Complete.
ERP-01-N26	Lassen National Forest Watershed Stewardship Within the Anadromous Watersheds of Butte, Deer and Mill Creeks This project helped to restore Butte, Deer, and Mill Creek watersheds through implementation of various restoration activities, including a public outreach element aimed at improving habitat for anadromous fish within these watersheds.	11/15/2004	\$849,845	Complete.
ERP-01-N27	Sonoma Creek Watershed Conservancy This project proposes to expand on the Conservancy's existing efforts to inform and engage the public in watershed issues while providing critical data for adaptive management.	3/16/2006	\$545,170	Complete.
ERP-01-N29	Kirker Creek Coordinated Resource Management & Planning Program Kirker Creek Watershed Coordinated Resource Management & Planning (CRMP) Program facilitated, coordinated, and supported the efforts of landowners, municipalities, community organizations, industry, and citizens of the Kirker Creek Watershed and developed a watershed management plan using the CRMP process.	7/16/2004	\$220,402	Complete.
ERP-01-N30	Digital Soil Survey Mapping and Digital Orthophotoquad Imagery Development This project made soils information more accessible to individuals and groups engaged in ecosystem restoration projects in the Bay-Delta Region, and in doing so, improve the responsiveness of these projects to establishing habitat and supporting sustainable populations of valuable species.	8/15/2004	\$430,390	Complete.
ERP-01-N47	Clear Creek Juvenile Salmonid Monitoring Project This project will provide funds for continued monitoring of juvenile salmonid conditions and outmigration in Clear Creek in order to provide information to managers in assessing the effectiveness of restoration activities funded through the CVPIA.	6/30/2007	\$1,405,142	All data for the project has been collected. Analysis of project data will be carried out under future CALFED/DFG contracts.
ERP-01-N48	Juvenile Salmon Migratory Behavior Study in the North Central and South Delta This research project was conducted to improve the understanding of juvenile anadromous salmonid migratory behavior in the Delta to enhance ongoing and future Delta ecosystem restoration efforts.	1/15/2004	\$210,000	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-N53	White Mallard Dam and Associated Diversions This project will provide funds for engineering design, permitting, and bidder's assistance to improve anadromous fish passage in Butte Creek, a tributary to the Sacramento River, while maintaining the viability of agriculture and managed wetlands in the Butte Sink and surrounding area.	4/30/2003	\$84,938	Complete.
ERP-01-N56	Patterson Irrigation District Positive Barrier Fish Screen Study on San Joaquin River Diversion Positive barrier fish screen on the San Joaquin River Pumping Plant will provide a reliable water supply for the irrigation district while protecting the San Joaquin River fishery.	12/31/2002	\$175,000	Complete.
ERP-01-N57	Lower Mokelumne River Restoration Program - Phase 2 This project prepares design and specifications for a proposed fish screen system along the Lower Mokelumne River.	2/28/2002	\$680,000	Complete.
ERP-02-C01-D	Upper Yuba River Studies Program - Sediment Studies and Water Quality The objective of this study is to improve the understanding of the current level of mercury contamination in Engelbright reservoir sediments and biota. Sediment studies will improve the understanding of sediment supply, transport, and storage of sediment in the Yuba River watershed. An assessment of the transport of the existing sediment in the reservoir to its downstream reaches will be performed following several potential management scenarios. The objective is to determine if the introduction of wild Chinook salmon and steelhead trout to the upper Yuba River is feasible in the long term.	6/30/2006	\$4,794,966	Complete.
ERP-02-C02-D	Upper Yuba River Studies Program: Engineering, Environmental Services, Project Management and Facilitation The objective is to determine if the introduction of wild Chinook salmon and steelhead trout to the upper Yuba River watershed is feasible in the long term. CH2M Hill will perform services defined by CALFED in writing, under individual task orders.	6/30/2006	\$4,422,038	Ongoing.
ERP-02-C07-D	Dutch Slough Tidal Marsh Restoration Project (Phase I) This project acquired the three contiguous parcels totaling 1,166 acres that comprise the Dutch Slough site.	12/31/2006	\$23,550,000	Complete.
ERP-02D-P53	Lower Deer Creek Restoration and Flood Management: Feasibility Study and Conceptual Design The project will evaluate the feasibility of setting back levees on Deer Creek and investigate the feasibility of allowing flood flows to access the natural floodplain in a controlled manner to improve habitat and flood control.	12/31/2008	\$1,519,200	Ongoing.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02D-P54	Restoring Ecosystem Integrity in the Northwest Delta: Phase II This project proposes to acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, and north Delta tidal channels located west of the Yolo Bypass.	8/31/2008	\$1,781,658	Ongoing.
ERP-02D-P57	Biological Assessment of Green Sturgeon in the Sacramento - San Joaquin Watershed This project proposes to continue research into the life history and habitat needs of green sturgeon. The project will investigate movements and distribution of these fish in the Bay-Delta system and describe their habitats, especially with emphasis on spawning sites.	1/31/2007	\$1,271,272	Complete.
ERP-02-P02	Upper Cosumnes River Watershed Conservation Project Acquire land totaling approximately 2,160 acres of riparian and upslope habitat along the North Fork of the Cosumnes River, within the Upper Cosumnes River Basin.	2/19/2004	\$2,000,000	Complete.
ERP-02-P03-D	Dutch Slough Restoration Project The purpose of this project is to develop a restoration plan for a 1,166 acre site adjacent to Dutch Slough and the mouth of Marsh Creek in the western Delta.	11/2/2008	\$1,500,000	Ongoing.
ERP-02-P25	McCormack-Williamson Tract Restoration: Wildlife-Friendly Levee Management The purpose for this project is to reslope 20,000 linear feet of the backslope of the levees on the McCormack-Williamson tract (MWT) to a 5:1 slope using on-site fill to increase the strength and stability of the MWT levee system while increasing riparian habitat.	12/31/2008	\$2,476,835	Ongoing.
ERP-02-P26	Mill and Deer Creeks Protection and Stewardship This project proposes to help address water quality and quantity, salmon habitat, and existing wildlife-friendly agriculture on Mill Creek and Deer Creek through conservation easements and active land stewardship.	12/31/2008	\$4,700,000	Ongoing.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P29	Tuolumne River Sediment Acquisition and Spawning Gravel Transfusion Project The Tuolumne River restoration project proposed to secure a long-term source of sediment necessary to implement present and future restoration projects, and add a large enough quantity of clean spawning gravel into the river to restore the supply that has been lost during the past century of sediment regulation. The applicant has proposed an amended Scope of Work; CBDA approval still pending as of August 2005. The amended project entails placement of 300,000 cubic yards of spawning-sized gravel in 2006 and 2007 to increase spawning habitat for Chinook salmon and steelhead in the lower Tuolumne River.	12/31/2008	\$4,350,000	Ongoing.
ERP-02-P49	Deer Creek Hills Project Entire project will purchase 4,000+ acres in the foothill region of the upper Consumnes River watershed. The current portion of the project will acquire +/- 294 acres of the Deer Creek Hills property. The site features blue oak woodland, vernal pools, and grasslands that are critical habitats that support a wide range of at risk species.	3/31/2004	\$800,000	Complete.
ERP-96-M04	Princeton Pumping Plant Fish Barriers Feasibility Study This project will provide funds to design and construct a fish screen at Reclamation District 1004's Princeton Pumping Plan to prevent the entrainment of winter-run Chinook salmon on the Sacramento River.	12/31/1997	\$75,000	Complete.
ERP-96-M13	Yolo Bypass Fish Habitat The objectives for this study are to examine the relationship between the Yolo Bypass and the rest of the Estuary and to develop recommendations for restoration actions that would improve Bypass habitat for fisheries and other aquatic organisms.	11/3/2000	\$226,000	Complete.
ERP-97-B04	San Joaquin River National Wildlife Refuge Riparian Habitat Protection and Floodplain Restoration Project - Phase I Acquire and plan restoration of additional floodplain lands for USFWS San Joaquin National Wildlife Refuge.	3/31/2002	\$10,947,000	Complete.
ERP-97-B05	Feasibility Analysis for the San Joaquin-Bear Creek Floodplain Restoration Project, San Luis National Wildlife Refuge, Merced County Evaluated the benefits and impacts of allowing seasonal flooding onto lands adjacent to Bear Creek and onto refuge lands. The purpose of this project is to restore unimpeded overflow to existing and future dedicated wetlands along the San Joaquin River system to the extent that impacts to adjacent lands and facilities can be mitigated and accepted.	9/30/2000	\$334,000	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-C03	Upper Sacramento River Fisheries and Riparian Habitat Management Program (SB 1086) Implementation: Watershed Management Planning Developed a non-profit watershed group that will implement the goals of the Upper Sacramento River Fisheries and Riparian Habitat Management Program (SB1086) to improve riparian habitat along the Sacramento River.	12/31/2000	\$200,000	Complete.
ERP-97-C11	Spawning Gravel Introduction, Tuolumne River, La Grange The project added 11,000 tons of gravel between the Old La Grange Bridge and Basso Bridge in the lower Tuolumne River in 1999 to increase and improve Chinook salmon spawning habitat.	12/31/2001	\$250,975	Complete.
ERP-97-M05	Saeltzer Dam Fish Passage Project, Clear Creek, Shasta County This project originally provided funds to replace the existing Saeltzer Dam on Clear Creek with a "fish-friendly" alternative consisting of a structure lower in height. In addition, the project originally included construction of a fish ladder and fish screen. However, the decision was made to remove the dam without replacing any structures. The Metropolitan Water District recommended the Western Shasta RCD be allowed to use the money to revegetate the dam removal site, but the WSRCD later withdrew the request. The \$238,000 originally awarded was never used.	10/31/1999	\$238,200	Terminated/cancelled.
ERP-97-N03a	Ecosystem and Natural Process Restoration on the Sacramento River: Active Restoration of Riparian Forest The US Fish and Wildlife Service (FWS) and The Nature Conservancy (TNC) actively restored 200 acres of flood-prone agricultural lands to native riparian forest along the Sacramento River between Keswick and Verona. Restoration was conducted on 200 acres of public lands within the 100 year floodplain.	6/20/2002	\$780,000	Complete.
ERP-97-N06	Butte Creek Riparian Protection and Restoration Project This project provides a portion of the funds for the acquisition of the McAmis Property, development of a management plan for the Ecological Preserve, and incorporation of the site into the Butte Creek Education Project.	12/31/2001	\$187,128	Complete.
ERP-97-N21	Knights Ferry Gravel Replenishment The project evaluated the effects of adding different sizes and sources of gravel on the utilization of spawning habitat by fall-run Chinook salmon and the quality of incubation habitat at 18 project sites in the lower Stanislaus River.	3/15/2002	\$561,406	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-B03	Fish Passage Improvement Project under Bay Delta Project - Category III This project consists of the planning phase for construction of fish passage improvement structures at the Anderson-Cottonwood Irrigation District main diversion dam for the benefit of anadromous fish.	3/31/1999	\$325,000	Complete.
ERP-98-B11	Lower Mokelumne River Restoration Plan - Phase 1 This project completed the preliminary work necessary to allow the future construction of fish passage improvements and fish screens at Woodbridge Dam on the Lower Mokelumne River.	2/5/2002	\$1,920,000	Complete.
ERP-98-B14	Irrigation Drainage Water Treatment for Selenium Removal: Panoche Drainage District Demonstration Facility Demonstrate the effectiveness of microalgae as a substrate for nitrate and selenium reduction in agricultural discharge water. Evaluate treatment effectiveness, operational issues and estimate costs of the process.	9/30/2002	\$1,171,956	Complete.
ERP-98-B16	Reconnaissance Investigation and Preliminary Design for Steelhead and Winter-run and Spring-run Chinook Passage Facilities This project represents the planning and preliminary design phase for the improvement of anadromous fish passage on Battle Creek through analysis of five sites for construction of fish screens and ladders.	6/30/2001	\$395,000	Complete.
ERP-98-B24	Fish Passage and Fish Screening Improvement Project, Phase II This project will provide funds for completing the final design, environmental documentation, and permitting for improved fish passage structures on the Anderson-Cottonwood Irrigation District diversion dam on the Sacramento River.	8/31/1999	\$840,759	Complete.
ERP-98-B34	Discover the Flyway Increase student awareness of wetlands and wildlife issues in the Yolo Basin.	12/31/2001	\$49,000	Complete.
ERP-98-B35	The Butte Creek Watershed Educational Workshops and Field Tours Series This project will provide funds to support the efforts of the Butte Creek Watershed Project (BCWP) to create education workshops and outreach materials focused on watershed issues. This project would include 13 workshops/field tours to be held over the course of eighteen months.	12/31/2002	\$32,275	Complete.
ERP-98-B40	Increase Public Awareness of the Riparian Habitat and Ecosystems of the Tuolumne River This project will implement educational programs to increase public knowledge and awareness of ecological issues and opportunities in Modesto, adjacent to the Tuolumne River.	12/31/2001	\$29,004	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP Implementation of monitoring and applied research that provide data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.
ERP-98-E01	Napa River Watershed Stewardship This project builds upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/31/2000	\$250,000	Complete.
ERP-98-E09	Merced River Corridor Restoration Plan - Phase II Analyze and quantify current in-channel, riparian, and floodplain conditions in the Merced River Corridor.	5/23/2001	\$345,443	Complete.
ERP-98-E10	South Yuba River Coordinated Watershed Management Plan This project facilitated broadbased local stakeholder group in development of watershed plan. The South Yuba River Coordinated Watershed Management Plan was developed for the 40 miles of South Yuba River between Spaulding and Englebright reservoirs.	5/30/2003	\$264,000	Complete.
ERP-98-E12	Lower Mokelumne River Watershed Stewardship Program (Phase I) Facilitated broadbased local stakeholder group in development of watershed plan, developed an Environmental Farm plan and expanded neotropical bird monitoring for the Mokelumne River Watershed.	9/1/2000	\$159,000	Complete.
ERP-98-E14	American River (North and Middle Forks) Integrated Watershed Plan and Stewardship Strategy This project developed a Watershed Management Plan and Stewardship Strategy to address a wide range of environmental, institutional, social, and economic issues for the watershed encompassing the North and Middle Forks of the American River.	12/31/2002	\$220,750	Complete.
ERP-98-E15	Sulphur Creek Coordinated Resource Management Planning Group Provided funds to support the ongoing efforts of the Sulphur Creek Coordinated Resources Management Planning Group, which is a broad-based local stakeholder group that works to implement restoration activities in the watershed.	5/10/2001	\$23,828	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-F01	Butte Creek Watershed Coordinator Assistant, Education Project, Road Survey Project, Geomorphology Analysis, and Restoration Implementation This project combined the tasks from four proposals submitted during the 1997 PSP year; 1) provided funds for an assistant watershed coordinator, 2) developed the Butte Creek Watershed Education Project, 3) funded the Butte Creek Watershed Road Survey, and 4) provided for a Geomorphology Analysis of Lower Butte Creek.	12/31/2001	\$302,745	Complete.
ERP-98-F11	Merced River Salmon Habitat Enhancement - Phase III (Robinson Reach) Goals: eliminate predator habitat, improve spawning and rearing habitat, and replant riparian vegetation. This project will restore natural conditions to Merced River habitat at river miles 42 to 43.5. Restoration will include filling/isolating deep pools, reconfiguring channel and floodplain characteristics, and increasing riparian habitat.	9/30/2002	\$2,433,000	Complete.
ERP-98-F15	Lower Clear Creek Floodway Restoration Project (Phase II) Improved salmon spawning and rearing habitat by implementing the Lower Clear Creek Watershed Management Plan and restoring 2.9 miles of floodplain and riverine aquatic habitat.	6/30/2006	\$4,561,939	Complete.
ERP-98-F23	South Napa River Tidal Slough and Floodplain Restoration Project This project represents the first phase in restoring over 460 acres of wetlands in the South Napa River Tidal Slough by funding acquisition of the property, preliminary design work, an environmental feasibility study, and environmental compliance documentation and permitting.	6/30/2001	\$1,480,000	Complete.
ERP-99-B04	Preliminary Design and Engineering of Lower Western Stone Site, Merced River Salmon Habitat Enhancement Project (Phase IV) Reduce entrainment of out-migrating fish. Improve river and floodplain dynamics and enhance the riparian corridor.	4/30/2003	\$125,000	Complete.
ERP-99-B05	Merced River Salmon Habitat Enhancement Project Phase II- Ratzlaff Reach Construction) Reduce entrainment and predation of out migrating fish. Isolate 45 acres of unnatural predator habitat from the river channel. Improve river and floodplain dynamics and enhance the riparian corridor. Increase the quantity and quality of in-stream spawning habitat. This funding covered costs for part of the construction.	3/30/2000	\$1,584,002	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-B11	South Napa River Tidal Slough and Floodplain Restoration Project This is Phase 2 of the South Napa River Tidal Slough and Floodplain Restoration Project, which involved the restoration of tidal flow to 2.3 miles of historic slough habitat, and the restoration of nearly 483 acres of wetlands and uplands.	9/30/2005	\$1,520,000	Complete.
ERP-99-B12	Riparian Corridor Acquisition & Restoration Assessment Project Protected critical habitat through conservation easements and fee title acquisitions, and provided a foundation for ecosystem restoration specific to the project area. Approximately five miles of Sacramento River frontage, 4.5 miles of Battle Creek frontage, and 3 miles of Sacramento River (river mile 271-274) frontage preserved. Acquisition and assessment only.	4/30/2003	\$2,052,236	Complete.
ERP-99-B18	An Evaluation of the Potential Impacts of the Chinese Mitten crab on the Benthic Communities in the Sacramento-San Joaquin Delta and Suisun Bay Provided information regarding the relationship between the Chinese mitten crab (<i>Eriocheir sinensis</i>) and the benthic invertebrate community within the Sacramento-San Joaquin Delta and Suisun Bay.	3/31/2003	\$178,764	Complete.
ERP-99-B22	Water Challenge 2010 Exhibit An interactive, hands-on environmental education exhibit.	6/30/2002	\$81,067	Complete.
ERP-99-B27	Watershed Educational Training (WET) Program This project increased public awareness of watershed issues through implementation of the Colusa County Resource Conservation District's (CCRCD) Watershed Educational Training (WET) project, which linked community watershed health with the ecological objectives and goals identified by the CBDA. The project was completed successfully and according to the final project summary, the educational projects reached approximately 61,365 people.	3/9/2003	\$12,886	Complete.
ERP-99-B29	Pilot Project to Benefit Riparian Vegetation Along the San Joaquin River Monitored the downstream effects of the augmented flows at ten recommended cross sections, including the response of riparian seedlings and saplings on the San Joaquin River. This pilot project released 35,000 acre-feet of water during the period of June through October 1999, for the purpose to promote dispersal and germination of seed from native riparian plant species.	4/8/2002	\$2,500,000	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-N01	ACID Fish Passage Improvement Project, Phase III This project will provide funds for the construction of improved fish passage structures on the Anderson-Cottonwood Irrigation District diversion dam on the Sacramento River.	9/1/2002	\$5,100,000	Complete.
ERP-99-N11	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units This project surveyed and mapped the non-native invasive plant species, purple loosestrife. This project developed a site specific adaptive management plan and comprehensive local eradication and control efforts.	1/10/2003	\$139,473	Complete.
ERP-99-N11b	Purple Loosestrife Prevention, Detection and Control Actions for the Sacramento - San Joaquin River Delta System and Associated Hydrological Units This project continued early detection, prevention and eradication/control work for purple loosestrife in the Phase I and Phase II areas (these phases were funded to ERP-99-N11 and ERP-99-F08).	12/31/2003	\$49,865	Complete.
ERP-99-N15	Lower Mokelumne River Watershed Stewardship Plan Program (Phase II/III) This project was a continuation of a previously funded project by completing preparation of the Lower Mokelumne River Watershed Stewardship Plan/Watershed Owner's Manual, Action Plan, and Monitoring and Evaluation Program and implemented the Initial Watershed Stewardship Actions.	6/30/2002	\$227,000	Complete.
ERP-99-N17	Yuba Watershed Council: A Collaborative Approach Supported the ongoing efforts of the Yuba Watershed Council (YWC) by funding a watershed coordinator, materials, equipment, and office space to provide coordination and assistance, adaptive management and monitoring, education and outreach, and continuity and program oversight of current and future watershed projects.	6/30/2003	\$142,618	Complete.
ERP-99-N21	Development of a River corridor Management Plan for the Lower American River Developed a River Corridor Management Plan (RCMP) for the lower American River between the Sacramento River and the Nimbus Dam in Sacramento County to serve as a planning framework and consensus-building process for pursuing CALFED's vision and objectives for ecosystem restoration along the American River.	4/1/2002	\$250,000	Complete.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-04D-S06	Juvenile Anadromous Salmonid Emigration Monitoring on the Sacramento River at the Glenn-Colusa Irrigation District (GCID) Fish Screen Bypass Channel Continuation of a DFG juvenile salmonid monitoring site (screw trap).	4/1/2008	\$90,072	Ongoing.
ERP-04-S11	Sacramento River Riparian Monitoring and Assessment Consolidated Projects The purpose of this project is to address Sacramento River corridor riparian vegetation restoration effectiveness and biological response as a function of time, location, restoration technique, river channel migration, and other natural processes. This project will quantitatively assess the extent to which past ERP funded restoration projects have achieved their stated goals, and through a scorecard approach will provide a means to track ERP project changes over time.	6/30/2009	\$1,261,057	Ongoing.
ERP-05D-S02	Data Collection for the San Joaquin Basin-wide Temperature Model This directed action provides the funding needed by DFG to carry out the support activities related to collecting, storing, and managing water temperature and meteorological data in support of developing the San Joaquin River Basin-Wide Water Temperature Model.	6/30/2008	\$781,000	Ongoing.
ERP-06D-S15	Sacramento River Conservation Area Forum (SRCAF) This project will provide funding to continue the efforts of the Sacramento River Conservation Area Forum to act as a coordinating body between local, state, and federal agencies regarding restoration activities in the Sacramento River watershed.	3/31/2010	\$656,277	Ongoing.
ERP-05-S33	Yolo-Solano Conservation Partnership Proposed project would continue to develop collaborations to address restoration permitting needs, increase technical and economic incentives for farmers to increase habitat, conduct economic assessments. Project would include riparian habitat enhancements, irrigation canal re-vegetation, farm pond habitats, and wildlife and vegetation monitoring along with studies on ecosystem services, outreach, and education.	9/1/2010	\$2,257,973	Ongoing.

Table 1. Freshwater Fish Habitat Project Summary.

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-07D-S03	Population Biology, Life History, Distribution, and Environmental Optima of Green Sturgeon This project would conduct telemetric, physiological, reproductive, and genetic studies to provide state and federal agencies such as NMFS and the California Department of Fish and Game (CDFG) with information on the size of the population and its critical habit within the Sacramento-San Joaquin watershed to inform the development of a recovery plan for the species. The distribution of spawning adults and juveniles will be continuously monitored using automated listening stations situated throughout the Sacramento River, Delta, and San Francisco Bay Estuary. The environment where adult green sturgeon are found to spawn will be characterized.	9/30/2009	\$969,690	Ongoing.
ERP-98-C15	Biological Assessment of Green Sturgeon in the Sacramento-San Joaquin Watersheds This project will investigate green sturgeon's biological requirements, such as food and oxygen requirements at different water temperatures, swimming performance, larvae and fry development needs, and effects of stressors on reproductive functioning.	10/31/2001	\$241,000	Complete.

Other Programs Contributing to ERP Vision

Implementation of the Central Valley Project Improvement Act (CVPIA) by the U.S. Fish and Wildlife Service (USFWS) and the U.S. Bureau of Reclamation (USBR) is another key program that provided for habitat restoration within the CALFED area including restoration of EFH.

Status of Topic Today

Actions to improve the condition of Freshwater Fish Habitat will continue to be implemented in the future primarily through multi-objective projects that include efforts to improve fish passage, replenish stream sediments especially spawning gravel, and improve floodplain-stream interactions.

Planned Projects for Implementation

Several projects listed in Table 1 made significant progress toward planning and feasibility, however many of these need to be promoted into the implementation phase for restoration and/or installation.

On the Yuba River, two projects worked to develop implementation and watershed plans: *Development of Implementation Plan for Lower Yuba River Anadromous Fish Habitat Restoration (ERP-99-B09)* developed an implementation plan and conducted modeling, public outreach, and local involvement plans, all of which are related to the Lower Yuba River Anadromous Fish Habitat Restoration Actions; and *South Yuba River Coordinated Watershed Management Plan (ERP-98-E10)* facilitated a broadbased local stakeholder group to develop a watershed plan for the 40 miles of South Yuba River between Spaulding and Englebright reservoirs. Both plans can be beneficial for future goals, priorities, and implementation.

On the American River, the *Development of a River Corridor Management Plan for the Lower American River (ERP-99-N21)* developed a River Corridor Management Plan for the lower American River between the Sacramento River and the Nimbus Dam to serve as a planning framework and consensus-building process for pursuing CALFED's vision and objectives for ecosystem restoration along the American River.

On the Merced River, *Preliminary Design and Engineering of Lower Western Stone Site, Merced River Salmon Habitat Enhancement Project (Phase IV) (ERP-99-B04)* developed preliminary design for the Lower Western Stone Site to eventually reduce entrainment of out-migrating fish, improve river and floodplain dynamics, and enhance the riparian corridor. In addition, the *Merced River Corridor Restoration Plan - Phase II (ERP-98-E09)* analyzed and quantified current in-channel, riparian, and floodplain conditions in the Merced River Corridor.

A *Feasibility Analysis for the San Joaquin-Bear Creek Floodplain Restoration Project, San Luis National Wildlife Refuge, Merced County (ERP-97-B05)* evaluated the benefits and impacts of allowing seasonal flooding onto lands adjacent to Bear Creek and onto refuge lands. The purpose of this project was to restore unimpeded overflow to existing and future dedicated wetlands along the San Joaquin River system to the extent that impacts to adjacent lands and facilities can be mitigated and accepted.

One project, *Lower Deer Creek Restoration and Flood Management: Feasibility Study and Conceptual Design (ERP-02D-P53)*, evaluated the feasibility of setting back levees on Deer Creek and investigated the feasibility of allowing flood flows to access the natural floodplain in a controlled manner to improve habitat and flood control.

In other areas, The *Dutch Slough Restoration Project (ERP-02-P03-D)* helped to develop a restoration plan for a 1,166 acre site adjacent to Dutch Slough and the mouth of Marsh Creek in the western Delta. The *McCormack-Williamson Tract Restoration Planning, Design and Monitoring Program I (ERP-00-F08)* performed baseline studies necessary for project planning and design, and the development of long-term monitoring programs of the McCormack-Williamson Tract, which is a 1,600-acre Delta island. Restoration work in both areas is expected in the future.

Lastly, the *Comprehensive Monitoring Assessment and Research Program – CMARP* (ERP-98-C10) provided the means for monitoring and applied research that provided data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs. This effort should be resurrected in the future

Impediments to Implementation

None.

References

CALFED Bay-Delta Program. 2000a. Ecosystem Restoration Program Plan - Volume I: Ecological Attributes of the San Francisco Bay-Delta Watershed. Final Programmatic EIS/EIR Technical Appendix. Sacramento, CA.

CALFED Bay-Delta Program. 2000b. Ecosystem Restoration Program Plan - Volume II: Ecological Management Zone Visions. Final Programmatic EIS/EIR Technical Appendix. Sacramento, CA.

4. ECOSYSTEM HABITATS

4.10. Essential Fish Habitat

Introduction

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for species regulated under a Federal Fisheries Management Plan (FMP) such as Pacific salmon. MSA was first enacted in 1976, and amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 was signed January 12, 2007 (NOAA Fisheries 2007).

EFH is the aquatic habitat necessary to fish for spawning, breeding, feeding, or growth to maturity to support the managed species population, a long-term sustainable fishery, and the species contribution to a healthy ecosystem (Federal Register 2002). The salmon fishery EFH includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon (PFMC 1999). In the estuarine and marine areas, salmon EFH extends from the nearshore and tidal submerged environments to 60 km offshore. Salmon EFH excludes areas upstream of longstanding naturally impassible barriers (i.e. natural waterfalls in existence for several hundred years).

The designation of these habitats is important to allow the systematic protection of biological diversity within distinct geographic regions. The application of such a conservation-oriented classification system is of particular importance in the Central Valley where a rapidly growing human population and large tracts of irrigated agriculture compete with aquatic organisms for water.

Habitat and biological associations examined in the development of proposed EFH included:

- Egg and spawning requirements.
- Larvae and alevins requirements.
- Juveniles in freshwater.
- Juveniles in estuarine waters.
- Juveniles in marine waters.
- Adult requirements.

NOAA Fisheries assumes a holistic approach toward implementation of EFH, and prefers not to subdivide by life stage or habitat type. The intent is to provide habitat conditions

that support all life-cycle stages of Chinook salmon, an approach fundamentally consistent with the ERP's emphasis on ecosystem management.

EFH is an integration of two major subdivisions: freshwater essential habitat and marine essential habitat. Important features of EFH for spawning, rearing and migration include adequate:

- Substrate composition.
- Freshwater quality (e.g., dissolved oxygen, nutrients, temperature).
- Freshwater quantity, depth and velocity.
- Channel gradient and stability.
- Food.
- Freshwater cover and habitat complexity (e.g. large woody debris, pools, channel complexity, aquatic vegetation).
- Space.
- Access and passage.
- Floodplain and habitat connectivity.
- Marine water quality.
- Marine water temperature.
- Marine prey species and forage base.
- Depth, cover, marine vegetation, and algae in estuarine and near-shore habitats.

Applicable ERP Vision

The vision for EFH is to maintain and improve the quality of existing habitats and to restore former habitats in order to support self-sustaining populations of Chinook salmon (CALFED 2000a).

The Strategic Objective is to restore large expanses of all major aquatic, wetland, and riparian habitats in the Central Valley and its rivers, as well as sufficient connectivity among those habitats, to support recovery and restoration of native species and biotic communities and rehabilitation of ecological processes.

Stage 1 Expectations

Stage 1 expectations were to complete inventories of habitat types within the CALFED area and prioritize these areas for conservation actions. Evaluation of restoration actions was encouraged as well as initiation of actions where feasible (CALFED 2000b). Within the East Delta Habitat Corridor, there was to be restoration of a large, contiguous corridor containing a mosaic of habitat types, including tidal perennial aquatic, riparian and riverine aquatic habitat, essential fish habitat, and improved floodplain-stream channel interactions (CALFED 2000b). The focus areas included the

South Fork of the Mokelumne River, East Delta dead-end sloughs, Georgiana Slough, Snodgrass Slough, and the Cosumnes River. Within the San Joaquin Habitat Corridor, restoration was to provide a contiguous habitat corridor of tidal perennial aquatic habitat, freshwater fish habitat, essential fish habitat, and improved river-floodplain interactions (CALFED 2000b).

Changes Attributable to ERP

All of the projects that benefited EFH had multiple objectives and also benefited other ecosystem elements. Projects are discussed in more detail in other element chapters within the report and EMZ chapters in Appendix A.

The ecosystem topic areas targeted by these projects were: 1) At-Risk Species Assessment; 2) Ecosystem Water and Sediment Quality; 3) Environmental Education; 4) Environmental Water Management; 5) Estuary Foodweb Productivity; 6) Fish Passage; 7) Fish Screens; 8) Harvestable Species Assessment; 9) Hydrodynamics, Sediment Transport, and Flow Regimes; 10) Local Watershed Stewardship; 11) Lowland Floodplains and Bypasses; 12) Mine Remediation; 13) Non-Native Invasive Species; 14) Riparian Habitat; 15) River Channel Restoration; 16) Sediment Transport and Flow Regimes; 17) Shallow Water and Marsh Habitat; 18) Upland Habitat and Wildlife Friendly Agriculture; and 19) X2 Relationships (Freshwater-Seawater Interface).

Project Summary Table

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
CVPIA-01-F02	Spawning Habitat & Floodplain Restoration in the Stanislaus River, Phase I Restored spawning and rearing habitat for salmonids in the Lover's Leap reach on the lower Stanislaus River.	Unknown	\$672,610	Complete. Gravel infusion.
CVPIA-01-F04	Tuolumne River Watershed Outreach and Stewardship Fostered local watershed stewardship through involvement and participation in implementation of the Tuolumne River Restoration Plan.	9/30/2002	\$62,000	Complete.
CVPIA-01-F06	Biological Assessment of Green sturgeon in the Sacramento-San Joaquin Watershed Continued addressing key areas of scientific uncertainty about green sturgeon, including new studies on sub-adult and adult movements, to refine our conceptual model and improve management of this species and its population(s) in the lower Sacramento-San Joaquin watershed.	6/30/2005	\$641,362	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
CVPIA-01-F09	San Joaquin River Chinook Salmon Age Determinations: Phase II Process and analyze the existing scale samples for the San Joaquin Basin to determine age structure of returning adult fall-run Chinook salmon.	9/30/2005	\$45,262	Ongoing.
CVPIA-01-F12	Lower Calaveras River Chinook Salmon and Steelhead Life History Limiting Factors Analysis Refined the understanding of how water management, in conjunction with other factors, limits the ability of Chinook salmon and steelhead to establish self-sustaining populations in the Calaveras River.	6/30/2006	\$500,797	Complete.
ERP-00-B06	Biological Assessment of Green Sturgeon in the Sacramento-San Joaquin Watershed (Phase II) The green sturgeon is a California Bay-Delta Authority Priority Group I species, and this project focused on the biological characteristics of this species and its habitats towards their eventual restoration.	7/3/2002	\$205,013	Complete.
ERP-00-E04	Sonoma Creek Watershed Conservancy Implemented riparian and aquatic habitat restoration activities and continued watershed stewardship and education programs in the Sonoma Creek watershed.	3/1/2004	\$438,923	Complete. Funded 800 ft. of riparian restoration by revegetating stream banks at 3 different sites on Carriger Creek.
ERP-00-E05	Merced River Corridor Restoration Project - Phase III Developed a publicly supported, technically sound, and implementable restoration plan for the Merced River corridor from Crocker-Huffman Dam downstream to the San Joaquin River.	11/1/2002	\$341,271	Complete.
ERP-00-F03	Floodplain Acquisition and Sub-reach/Site Specific Management Planning on the Sacramento River (Red Bluff to Colusa) Acquisition of 9 parcels (1,733 acres) within the SB 1086 Sacramento River Conservation Area (Red Bluff to Colusa); baseline assessment/start-up stewardship for newly acquired parcels; site-specific management planning for the "Beehive Bend Subreach"; monitoring; and project management.	9/30/2003	\$519,000	Complete.
ERP-00-F06	Liberty Island Acquisition Acquired fee title interest in the remaining two privately-owned properties on Liberty Island, estimated at 449 acres; and to conduct restoration of tidal shallow water habitat, tidal emergent wetlands, and seasonal wetlands for aquatic and terrestrial species.	9/30/2007	\$2,625,153	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-F08	McCormack-Williamson Tract Restoration Planning, Design and Monitoring Program I Performed baseline studies necessary for project planning and design, and the development of long-term monitoring programs of the McCormack-Williamson Tract (M-W), which is a 1,600-acre delta island.	8/1/2003	\$556,200	Complete.
ERP-01-C02	Real-Time Flow Monitoring Funded continued operation and maintenance of flow monitoring stations on five Sacramento River tributaries to provide data on minimum instream flows and water quality for the recovery of at-risk fish species in the creeks.	9/30/2005	\$518,200	Complete.
ERP-01-C06	Sedimentation in the Delta and Suisun Bay Described the movement of sediment affecting habitats in the Sacramento-San Joaquin Delta and described the availability of sediment needed for habitat restoration.	6/14/2005	\$1,630,391	Project successfully completed. It produced numerous papers on sediment flux and bedload transport in the delta.
ERP-01-C08-D	Technical and Scientific Services for the Upper Yuba River Studies Program USGS investigated water quality and sediment transport and yield in the Yuba River watershed. The overall objective was to improve understanding of sediment supply, transport, and storage of sediment in the Yuba River watershed, and to improve understanding of the current level of mercury contamination of Englebright Lake sediments and biota. An assessment of the transport of the existing sediment in the reservoir to the downstream reaches was performed following several potential management scenarios.	6/14/2005	\$534,000	Complete.
ERP-01-C09	Hill Slough West Habitat Restoration Demonstration Project, Phase II Completed the environmental documentation and permitting for a multi-phased project to restore tidal action to seasonal and permanent wetlands in the Suisun Marsh.	11/30/2006	\$87,000	Complete.
ERP-01-C10	Technical / Scientific Review of Upper Yuba River Studies Program: Ecotoxicology Expert Provided technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program.	6/30/2006	\$44,000	Complete.
ERP-01-C11	Technical / Scientific Review of Upper Yuba River Studies Program: Hydrotechnical Engineering Expert Provided technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program.	6/30/2006	\$28,000	Complete.
ERP-01-C12	Technical / Scientific Review of Upper Yuba River Studies Program: Environmental Economics Expert Provided technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program.	6/30/2006	\$28,000	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-C13	Technical / Scientific Review of Upper Yuba River Studies Program: Geomorphology Expert Provided technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program.	6/30/2006	\$28,000	Complete.
ERP-01-C14	Technical / Scientific Review of Upper Yuba River Studies Program: Zoology Expert Provided technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program.	6/30/2006	\$28,000	Complete.
ERP-01-C15	Technical/Scientific Review of Upper Yuba River Studies Program: Hydropower Expert Provided technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program.	6/30/2006	\$26,000	Complete.
ERP-01-C16	Technical / Scientific Review of Upper Yuba River Studies Program: Marine Fisheries and Economics Expert Provided technical expertise to the CALFED Bay-Delta Program, Upper Yuba Rivers Studies Program.	6/30/2006	\$26,000	Complete.
ERP-01-N08	San Joaquin River NWR Riparian Habitat Protection & Floodplain Restoration Project - Phase II Funded easement acquisition. Restored riparian and wetland habitat. Reintroduced riparian brush rabbits. Monitor. Associated project (ERP-97-B04) for Phase I.	12/31/2006	\$7,968,112	Complete. Acquired 361.97 acres of riparian and riverine aquatic - riparian, seasonal wetland - connected. 808 acres reported restored were riparian habitat.
ERP-01-N09	Tuolumne River Fine Sediment Management (Gasburg Creek) Reduced the supply of fine sediment to increased substrate permeability for Chinook salmon.	12/31/2007	\$995,119	Project has yet to complete closeout. Deliverables are still outstanding.
ERP-01-N19	Ecological Monitoring of Tolay & Cullinan Ranch Tidal Wetlands Restoration Monitored the Tolay Creek (ERP-97-N19) and Cullinan Ranch (ERP-97-N18) Tidal Wetland Restoration Projects in the North San Francisco Bay.	6/30/2006	\$593,931	Complete.
ERP-01-N24	Battle Creek Conservation Easements Acquisitions, Management, and Restoration Planning Funded the acquisition of conservation easements on three properties in the Battle Creek watershed for the benefit of Chinook salmon and steelhead restoration efforts.	10/31/2004	\$1,000,000	Complete. Acquired Miller (Burton) Ranch, 3 miles of stream length, 1,511 acres; Winning Ranch 700 acres; 2 miles of stream length, 988 acres (pristine riparian, upland agriculture, fresh emergent wetland, perennial grasses, irrigated pasture, blue oak woodland)

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-N26	Lassen National Forest Watershed Stewardship Within the Anadromous Watersheds of Butte, Deer and Mill Creeks Helped to restore Butte, Deer, and Mill Creek watersheds through implementation of various restoration activities, including a public outreach element aimed at improving habitat for anadromous fish within these watersheds.	11/15/2004	\$849,845	Complete.
ERP-01-N28	Sacramento River Conservation Area Program Funded efforts of the Sacramento River Conservation Area Program to act as a coordinating body between local, state, and federal agencies regarding restoration activities in the Sacramento River watershed.	6/30/2007	\$1,034,249	Complete.
ERP-01-N44	Estimating the Abundance of Sacramento River Juvenile Winter Chinook Developed juvenile production indices and correlated those indices with estimated escapement from adult counts at Red Bluff Diversion Dam and from the winter-run carcass survey.	12/31/2006	\$2,443,005	Complete.
ERP-01-N45	Battle Creek Anadromous Salmonid Monitoring Program Comprised of three Battle Creek salmonid monitoring projects to provide monitoring information for use in adaptive management of the Battle Creek Salmon and Steelhead Restoration Program: 1) adult fish counting and trapping at the Coleman barrier weir; 2) adult, redd, and carcass surveys, and 3) juvenile fish monitoring using two rotary screw traps.	6/30/2007	\$3,083,314	All data for the project has been collected. Analysis of project data will be carried out under future CALFED/DFG contracts
ERP-01-N47	Clear Creek Juvenile Salmonid Monitoring Project Provided funds for continued monitoring of juvenile salmonid conditions and outmigration in Clear Creek in order to provide information to managers in assessing the effectiveness of restoration activities funded through the CVPIA.	6/30/2007	\$1,405,142	All data for the project has been collected. Analysis of project data will be carried out under future CALFED/DFG contracts
ERP-01-N48	Juvenile Salmon Migratory Behavior Study in North and Central Delta using Radio Telemetry Improved the understanding of juvenile anadromous salmonids migratory behavior in the Delta to enhance ongoing and future Delta ecosystem restoration efforts.	1/15/2004	\$210,000	Complete. Scope of work was changed to move the South Delta site to an additional Central Delta site.
ERP-01-N49	Butte Creek, Big Chico Creek, and Sutter Bypass Chinook Salmon and Steelhead Evaluation Provided information on the basic life history of spring-run Chinook salmon and steelhead trout populations in Butte and Big Chico Creeks to help evaluate the effectiveness of many fish restoration projects intended to improve anadromous fish populations in the two watersheds.	6/30/2006	\$507,132	This project was funded for an additional 3 years under ERP-04-S10. At that time, a final report will be submitted.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-N53	White Mallard Dam and Associated Diversions Provided funds for engineering design, permitting, and bidder's assistance to improve anadromous fish passage in Butte Creek, a tributary to the Sacramento River, while maintaining the viability of agriculture and managed wetlands in the Butte Sink and surrounding area.	4/30/2003	\$84,938	Complete.
ERP-01-N55	RD 2035 Fish Screen and Environmental Design Review Provided engineering design services for a 400-cfs landslide pump station and screened intake facility.	12/31/2003	\$1,384,000	Complete.
ERP-01-N57	Lower Mokelumne River Restoration Program - Phase 2 Prepared designs and specifications for a proposed fish screen system along the Lower Mokelumne River.	2/28/2002	\$680,000	Complete.
ERP-01-N58	Fish Passage Improvement at the Red Bluff Diversion Dam: Balance of Phase II Funding Helped reduce and minimize the impacts of the Sacramento River's Red Bluff Diversion Dam on upstream and downstream migration of juvenile and adult anadromous fish, while improving agricultural water supply.	9/30/2004	\$734,000	Complete.
ERP-01-N62	Yuba Feather Work Group Provided funds to support a community-based stakeholder approach to providing input into Yuba County Water Agency's Proposition 13 Yuba Feather Flood Control Study on various non new-dam watershed management techniques to enhance flood protection while maintaining or improving natural process, habitat and populations of high priority at risk species, including Chinook salmon and steelhead.	8/31/2006	\$297,632	Complete.
ERP-02-C01-D	Upper Yuba River Studies Program - Sediment Studies and Water Quality Improved the understanding of the current level of mercury contamination in Englebright reservoir sediments and biota. Sediment studies improved the understanding of sediment supply, transport, and storage of sediment in the Yuba River watershed. An assessment of the transport of the existing sediment in the reservoir to its downstream reaches was performed following several potential management scenarios. Determined if the introduction of wild Chinook salmon and steelhead trout to the upper Yuba River is feasible in the long term.	6/30/2006	\$4,794,966	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-C02-D	Upper Yuba River Studies Program: Engineering, Environmental Services, Project Management and Facilitation The objective was to determine if the introduction of wild Chinook salmon and steelhead trout to the upper Yuba River watershed is feasible in the long term. CH2M Hill was to perform services defined by CALFED in writing, under individual task orders.	6/30/2006	\$4,422,038	Final deliverables never received.
ERP-02-C04-D	Two-Dimensional Detailed Hydraulic Model for Determining Flood Conveyance Impacts of Ecosystem Restoration Projects in the Yolo Bypass Carried out a topographic update and improvement of the existing Yolo Bypass RMA-2 2-D hydraulic model. The model's geometry was updated and refined, calibrated, validated, and tested.	6/1/2006	\$500,257	Complete.
ERP-02-C08	Restoration of Eastern Delta Floodplain Habitats on Grizzly Slough in the Cosumnes River Watershed - Phase I Phase 1 in an effort to restore function to an historic seasonal floodplain on Grizzly Slough in the Cosumnes River watershed. The project was formerly ERP-02-P05. This project was part of a multi-project interagency agreement with DWR #264000.	6/30/2006	\$300,000	Complete. The project produced a set of scientifically sound and ecologically based restoration alternatives for the Grizzly Slough site.
ERP-02D-P53	Lower Deer Creek Restoration and Flood Management: Feasibility Study and Conceptual Design Will evaluate the feasibility of setting back levees on Deer Creek and investigate the feasibility of allowing flood flows to access the natural floodplain in a controlled manner to improve habitat and flood control.	10/31/2008	\$1,519,200	Ongoing.
ERP-02D-P57	Biological Assessment of Green Sturgeon in the Sacramento - San Joaquin Watershed Continued research into the life history and habitat needs of green sturgeon. The project investigated movements and distribution of these fish in the Bay-Delta system and described their habitats, especially with emphasis on spawning sites.	1/31/2/07	\$1,271,272	Complete.
ERP-02-P02	Upper Cosumnes River Watershed Conservation Project Acquired land totaling approximately 2,160 acres of riparian and upslope habitat along the North Fork of the Cosumnes River, within the Upper Cosumnes River Basin.	2/19/2004	\$2,000,000	Complete.
ERP-02-P07	Butte Sink Water Control Structure Modifications - Phase III Construction Provided passage for adult salmonids by installing fish ladders and overflow gates at the Morton and End weirs and a control weir at the North Weir site to keep adult salmon and steelhead in the main migration path of Butte Creek.	07/31/2008	\$5,748,112	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P19	Determining the Mechanisms Relating Freshwater Flow and Abundance of Estuarine Biota (the "Fish-X2" relationships) Phase I Phase I of a research program. The ultimate purpose was to contribute to the understanding of the factors that control the distribution and abundance of estuarine species, how these factors vary with X2, and how they might change in the future.	6/30/2007	\$509,222	Complete.
ERP-02-P22	Shallow Open Water Habitats: Hydrodynamics and Benthic Grazing Developed, via field observation and modeling, a detailed view of how tides and wind-generated waves determine the physical structure and hydrodynamics of shallow estuarine waters, and how these physical processes can act to constrain net primary production through their effects on grazing and light. Field experiments will be carried out in the shallows of Grizzly Bay and in Franks Tract.	5/31/2007	\$616,605	Complete.
ERP-02-P26	Mill and Deer Creeks Protection and Stewardship Proposes to help address water quality and quantity, salmon habitat, and existing wildlife-friendly agriculture on Mill Creek and Deer Creek through conservation easements and active land stewardship.	12/31/2008	\$4,700,000	Project will acquire conservation easements on over 26,000 acres of land on Mill Creek, and over 10,000 acres on Deer Creek.
ERP-02-P28	Stanislaus - Lower San Joaquin River Water Temperature Modeling and Analysis Performed modeling and analysis of various alternatives for water management in the Stanislaus River.	10/31/2006	\$878,827	Complete. Extended in another ERP project (ERP-06D-S20) to include the Tuolumne, Merced, and Lower San Joaquin Rivers.
ERP-02-P29	Tuolumne River Sediment Acquisition and Spawning Gravel Transfusion Project The Tuolumne River restoration project proposes to secure a long-term source of sediment necessary to implement present and future restoration projects, and add a large quantity of clean spawning gravel into the river for restoration.	12/31/2008	\$4,350,000	Pending. Project amendment not approved because of a substantial change in the scope of work from the original project proposal that would remove the acquisition and on-site gravel work.
ERP-02-P47	Narrows II Flow Bypass System Constructed bypass system to eliminate flow and temperature fluctuations from emergency and maintenance shutdowns at the Narrows 2 Hydropower Plant on the Yuba River.	6/30/2008	\$8,535,567	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P49	Deer Creek Hills Project Acquired 294 acres of the Deer Creek Hills property. The site features blue oak woodland, vernal pools,	3/31/2004	\$800,000	Complete. Contains seasonal wetlands - vernal pools; perennial grassland, riparian and riverine aquatic - riparian; agricultural land - grazing; blue oak savannah.
ERP-03-C04	Technical/Scientific Review of Upper Yuba River Studies Program: Geomorphology and Hydrology Expert Dr. Gordon Grant of the USFS provided technical expertise to the CALFED Bay-Delta Program's Upper Yuba Rivers Studies Program.	6/30/2006	\$18,000	Complete.
ERP-04D-S06	Juvenile Anadromous Salmonid Emigration Monitoring on the Sacramento River at the Glenn-Colusa Irrigation District (GCID) Fish Screen Bypass Channel Continues an existing juvenile salmonid monitoring project located at the Glenn Colusa Irrigation District diversion on the Sacramento River near Hamilton City.	4/1/2008	\$90,072	Ongoing.
ERP-04D-S07	Real-Time Flow Monitoring Operate and maintain 13 flow monitoring stations with temperature sensors.	9/30/2008	\$330,000	Ongoing.
ERP-04D-S08a	Upper Sacramento River Basin Chinook Salmon Escapement Monitoring Program (PFMC) Monitors the annual abundance, migration timing, spawning distribution, and several life history characteristics of hatchery and natural winter, spring, late-fall and fall-run Chinook salmon during the 2006, 2007, and 2008 spawning seasons.	12/31/2008	\$777,700	Ongoing.
ERP-04D-S08b	Upper Sacramento River Basin Chinook Salmon Escapement Monitoring Program (CDFG) Monitors the annual abundance, migration timing, spawning distribution, and several life history characteristics of hatchery and natural winter, spring, late-fall and fall-run Chinook salmon during the 2006, 2007, and 2008 spawning seasons. The DFG contracted directly for the major equipment purchases to be made.	12/31/2008	\$68,500	Ongoing.
ERP-04D-S08c	Upper Sacramento River Basin Chinook Salmon Escapement Monitoring Program (USFWS) Estimates the abundance of winter-run Chinook salmon spawners and evaluates the winter-run Chinook propagation program at the Livingston Stone National Fish Hatchery.	3/31/2010	\$496,210	Ongoing.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-04D-S22	San Joaquin River Fall-Run Chinook Salmon Population Model Refinement Project Refines a fall-run Chinook salmon population prediction computer simulation model for the San Joaquin River. Will provide review, refinement, and improvements to existing San Joaquin River Fall-run Chinook Salmon Population Prediction Model, as well as provide a User Guide for the refined model.	6/30/2008	\$250,000	Project status unknown; ERP is lacking deliverables.
ERP-04-S10	Butte Creek Spring-run Chinook Salmon Life History Investigation Develops and refines SRCS adult escapement estimates.	6/30/2010	\$513,144	Ongoing.
ERP-04-S16	Clear Creek Anadromous Salmonid Monitoring Program A comprehensive salmonid monitoring program that will provide feedback for the adaptive management and evaluation of restoration actions of the Clear Creek Restoration Program and B2 Water Program.	12/31/2009	\$1,974,068	Ongoing.
ERP-05D-S04	Development of a Comprehensive Central Valley Adult Chinook Salmon Escapement Monitoring Plan Develops a long-term comprehensive plan designed to estimate population status and trends in abundance of adult Central Valley salmon in a statistically valid manner.	9/30/2009	\$373,349	Ongoing.
ERP-05D-S05	Development of a Central Valley Steelhead Comprehensive Monitoring Plan The Central Valley Steelhead Monitoring Plan will be a comprehensive plan for steelhead population monitoring that, when implemented, will provide the data necessary to assess whether or not restoration and recovery goals are being achieved, and to improve management of the species.	6/30/2009	\$367,888	Ongoing.
ERP-05D-S11	Determination of Age Structure and Cohort Reconstruction of Central Valley Chinook Salmon Populations. Accurately determines the age of all returning Chinook salmon populations to the Central Valley, using the aging data, in combination with the Coded-wire Tag (CWT) recovery data.	1/31/2009	\$637,412	Ongoing.
ERP-05D-S18	Lower Clear Creek Floodway Rehabilitation Project (Phase 3B) Will reconstruct the bankfull channel, monitor project implementation, and stabilize a headcut.	1/31/2010	\$3,482,451	Ongoing.
ERP-05D-S20	Implementation of a Constant Fractional Marking/Tagging Program for Central Valley Hatchery Chinook Salmon Marking/tagging program that provides CALFED the specific information needed to evaluate Ecosystem Restoration Program Plan (ERPP) actions and goals related to improving conditions for Central Valley Chinook salmon.	9/30/2008	\$6,775,998	Ongoing.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-05-S24	Farmer and Rancher Assisted Ecosystem Restoration and Watershed Stewardship Projects Conducts multiple projects on-the-ground within the Cow Creek Watershed. It is anticipated that the project will improve water quality, riparian health and ecosystem restoration. The stated project objectives are to (1) improve salmonid recovery in salmon-bearing streams and (2) improve current range and wetland facilities. Public outreach activities are also proposed.	2/28/2010	\$275,000	Ongoing.
ERP-06D-S15	Sacramento River Conservation Area Forum (SRCAF) Funds efforts of the Sacramento River Conservation Area Forum to act as a coordinating body between local, state, and federal agencies regarding restoration activities in the Sacramento River watershed.	3/31/2010	\$656,277	Ongoing.
ERP-06D-S18	Anadromous Fish Habitat Monitoring for the Battle Creek Salmon & Steelhead Restoration Implements Anadromous Fish and Habitat Monitoring for the Battle Creek Salmon and Steelhead Restoration Project. Sample tasks include: counts of Chinook salmon and steelhead returning to Battle Creek via the Coleman National Fish Hatchery(CNFH) barrier weir fish ladder; use of a rotary screw trap at CNFH to estimate juvenile production of Chinook salmon and steelhead; radio telemetry studies; instream studies upstream of CNFH; monitoring of stream-flow conditions on the North and South Forks of Battle Creek; installation of a weather station in the town of Manton to monitor climatic conditions; sediment monitoring; riparian habitat and coldwater refuge studies.	1/31/2010	\$3,360,000	Ongoing.
ERP-06D-S20	San Joaquin River Basin Water Temperature Modeling and Analysis Expands the Stanislaus River temperature model developed under ERP-02-P28 to the Merced, Tuolumne & San Joaquin above Stanislaus R. confluence.	12/31/2008	\$716,052	Project is in progress and assisted by DFG by a directed action that collects water temperatures (ERP-05D-S02)
ERP-07D-S03	Population Biology, Life History, Distribution, and Environmental Optima of Green Sturgeon Conducts telemetric, physiological, reproductive, and genetic studies to provide state and federal agencies such as NMFS and the California Department of Fish and Game (CDFG) with information on the size of the population and its critical habitat within the Sacramento-San Joaquin watershed to inform the development of a recovery plan for the species. The distribution of spawning adults and juveniles will be continuously monitored using automated listening stations situated throughout the Sacramento River, Delta, and San Francisco Bay Estuary. The project will also characterize the environment where adult green sturgeon are found to spawn.	9/30/2009	\$969,691	Ongoing.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-95-M02	Durham Mutual Water Company Diversion Dam Fish Screen and Ladder Project Funded construction of a fish screen and ladder on Butte Creek to improve fish passage for spring-run Chinook salmon and other anadromous fish.	12/31/1998	\$316,500	Complete.
ERP-95-M04	Sacramento River Spawning Gravel Restoration Project (below Keswick Dam) Restored several miles below the Keswick Dam on the Sacramento River by introducing spawning-sized gravel for natural redistribution and use by salmon as spawning habitat.	11/1/1995	\$39,400	Complete.
ERP-95-M05	M&T/Parrott Pumping Station and Fish Screen Project Relocated M&T Ranches' Parrot-Phelan Pumping Station and implementation of fish screens on diversion structures to reduce fish entrainment on Big Chico Creek.	12/31/1997	\$1,610,000	Complete.
ERP-95-M07	Suisun Marsh Fish Screen Project Phase 1 (diversion evaluation and selection) of a larger program to construct fish screens on 5 diversions in the Suisun Marsh to reduce downstream migrant salmonid mortality and mortality of delta smelt and splittail.	11/31/1996	\$450,000	Complete.
ERP-96-M01	Butte Creek Siphon and Associated Improvements Improved fish passage while maintaining water deliveries to Western Canal Water District customers by removing four diversion dams and constructing several new facilities along Butte Creek.	12/31/1998	\$3,095,873	Complete.
ERP-96-M03	Phase I of the Feasibility Study of the Lower Sacramento River Riparian Habitat Restoration Project Conducted a feasibility study to identify and design plans for potential sites to be revegetated to increase the amount of shaded riverine aquatic habitat along the lower Sacramento River. An important goal of this project was the evaluation of the impact that riparian habitat restoration has on both the Sacramento Flood Control System and the non-project levees in the Delta and adjoining areas.	9/14/1999	\$500,000	Complete.
ERP-96-M04	Princeton Pumping Plant Fish Barriers Feasibility Study Provided funds to design and construct a fish screen at Reclamation District 1004's Princeton Pumping Plan to prevent the entrainment of winter-run Chinook salmon on the Sacramento River.	12/31/1997	\$75,000	Complete.
ERP-96-M10	Applied Research to Predict Ecological Functions of Evolution of Restored Diked Wetlands Analyzed historically-breached dike wetlands in Delta as a means to predict the feasibility, patterns and rates of restoration to natural function that would be expected from breached-dike restoration strategies.	12/31/1999	\$475,000	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-96-M12	Battle Creek Chinook Salmon and Steelhead Restoration Plan Collected data to create a watershed plan as part of the overall watershed strategy used for implementing the Battle Creek Salmon and Steelhead Restoration Project.	10/1/1999	\$306,000	Complete.
ERP-96-M13	Yolo Bypass Fish Habitat Examined the relationship between the Yolo Bypass and the rest of the Estuary and to develop recommendations for restoration actions that would improve Bypass habitat for fisheries and other aquatic organisms.	11/3/2000	\$226,000	Complete
ERP-96-M17	Browns Valley Irrigation District Fish Screen Project Reduced entrainment of important anadromous fish species by providing funds for the construction of a fish screen at the Browns Valley Irrigation District's diversion facility on the Yuba River.	12/31/1999	\$114,750	Complete.
ERP-96-M19	Feasibility Study for Intake Screen at Wilkins Slough Diversion Phase II (feasibility study) of a five-phase project to design and construct a state-of-the-art fish screen at Reclamation District 108's Wilkins Slough diversion facility on the Yuba River to reduce entrainment of anadromous fish.	6/30/1997	\$100,000	Complete.
ERP-96-M22	Gorri Dam Fish Screen and Fish Ladder Project Studied feasibility of a fish ladder and screen on Gorri Dam on Butte Creek to reduce entrainment and improve passage for anadromous fish.	12/31/1998	\$67,990	Complete.
ERP-96-M25	Battle Creek Watershed Management Strategy Provided funds to form a watershed conservancy and create a "community plan" for the Battle Creek watershed that supplemented the existing "technical plan" and provided a two-tiered document for restoration activities in the watershed based on collaboration between stakeholders.	10/15/1999	\$100,000	Complete.
ERP-96-M26	Prospect Island Monitoring Plan Project A monitoring plan to evaluate the biological, chemical and physical effects of the Prospect Island Restoration Project was developed under this contract. The monitoring plan evaluated the extent of benefits of conversion of agricultural land to shallow water tidal habitat to aquatic, terrestrial and avian species.	6/30/1998	\$35,000.00	Complete.
ERP-96-M27	Inventory of Rearing Habitat for Juvenile Salmon in the North Delta Project Inventoried rearing habitat for juvenile Chinook salmon and other native fishes in the northern Sacramento-San Joaquin Delta.	9/30/1998	\$24,500	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-B01	Watershed Improvement: Stabilization of Potential Sediment Sources within the Deer, Mill, Antelope Creek Watersheds on Lassen National Forest Lands (Phase 1 of 2 Phases) Stabilized potential sediment sources within the Deer, Mill, and Antelope Creek watersheds on Lassen National Forest lands for the benefit of anadromous fish species.	3/31/2001	\$371,000	Complete.
ERP-97-B03	Liberty Island Acquisition Protected and restored tidally influenced wetlands, riparian corridors, and upland habitats on Liberty Island in the Yolo Bypass.	9/30/2003	\$8,926,000	Complete. Acquired 4,760 acres of Liberty Island.
ERP-97-B04	San Joaquin River National Wildlife Refuge Riparian Habitat Protection and Floodplain Restoration Project - Phase I Acquired and planned restoration of additional floodplain lands for USFWS San Joaquin National Wildlife Refuge.	3/31/2002	\$10,947,000	Complete. Acquired 3,112 acres (in fee title) of San Joaquin River floodplain on west side of river.
ERP-97-B05	Feasibility Analysis for the San Joaquin-Bear Creek Floodplain Restoration Project, San Luis National Wildlife Refuge, Merced County Evaluated the benefits and impacts of allowing seasonal flooding onto lands adjacent to Bear Creek onto refuge lands. The purpose of this project is to restore unimpeded overflow to existing and future dedicated wetlands along the San Joaquin River system to the extent that impacts to adjacent lands and facilities can be mitigated and accepted.	9/30/2000	\$334,000	Complete.
ERP-97-B06	Assessment of the Sacramento – San Joaquin River Delta as Habitat for Production of the Food Resources that Support Fish Recruitment Evaluated habitat influences on the production and utilization of organic matter as food source in the Delta and improve modeling capabilities. Obtained or measured food quality and quantity from various locations and habitat types.	9/30/2001	\$923,429	Complete. Eight presentations made at the annual meeting of the Estuarine Federation Conference in 2001.
ERP-97-C01	Positive Barrier Fish Screen Project, Wilkins Slough Pumping Plant Constructed a positive fish barrier intake screen at Reclamation District 108's diversion structure at Wilkins Slough for the protection of Chinook, splittail, and other fish species.	12/31/1999	\$2,500,000	Complete.
ERP-97-C03	Upper Sacramento River Fisheries and Riparian Habitat Management Program (SB 1086) Implementation: Watershed Management Planning Developed a non-profit watershed group that will implement the goals of the Upper Sacramento River Fisheries and Riparian Habitat Management Program (SB1086) to improve riparian habitat along the Sacramento River.	12/31/2000	\$200,000	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-C07	Preventing Exotic Introductions from Ballast Water Increased maritime industry members' awareness of ballast water release issues and alternative practices in order to reduce the introduction of nonnative species into the Delta.	8/31/2001	\$222,830	Complete.
ERP-97-C11	Spawning Gravel Introduction, Tuolumne River, La Grange Added 11,000 tons of gravel between the Old La Grange Bridge and Basso Bridge in the lower Tuolumne River in 1999 to increase and improve Chinook salmon spawning habitat.	12/31/2001	\$250,975	Complete.
ERP-97-E01	Big Chico Creek Watershed: Phase I Provided funds for the creation of a Watershed Management Strategy for Big Chico Creek to serve as a tool for the protection and restoration of the watershed.	12/31/1999	\$422,830	Complete.
ERP-97-E02	Deer Creek Watershed Management/Implementation Program, Phase II Supported on-going watershed monitoring and education programs in the Deer Creek watershed as directed by the Deer Creek Watershed Management Strategy, aimed at enhancing and improving stream habitat for anadromous fish and providing resources for implementation of restoration and monitoring activities in the watershed.	12/31/1999	\$196,554	Complete.
ERP-97-M02	Engineering Investigation of Anadromous Fish Passage in Upper Battle Creek Project Consisted of the preliminary design phase for construction of fish screens and ladders to improve passage of anadromous fish along the North and South Forks of Battle Creek.	6/30/2002	\$395,000	Complete.
ERP-97-M03	Gorrill Dam Fish Screen and Fish Ladder Project Provided funds to construct a fish ladder and fish screen at the Gorrill Dam on Butte Creek to reduce entrainment and improvement passage for anadromous fish.	12/31/1999	\$369,641	Complete.
ERP-97-N01	Assessment and Implementation of Urban Use Reduction of Diazinon and Chlorpyrifos (Sacramento County) Identified, evaluated and controlled the toxicity runoff caused by elevated levels of diazinon and chlorpyrifos within Sacramento County. Tasks included water quality monitoring to determine baseline conditions, developing outreach/education program for residential and other urban users (through the use of surveys and subsequent evaluations), and performing analyses of the fate, transport and risk assessment for the chemicals.	1/1/2001	\$663,500	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-N02	Sacramento River Floodplain Acquisition and Riparian Forest Restoration Increased the extent of channel meander and flood zones. Mapping of aquatic and terrestrial habitats. Increased native riparian growth and reduced exotic distribution adjacent to the river.	12/31/2002	\$9,905,438	Complete. Acquired 1,880 acres, Sacramento River Conservation Area between Keswick and Verona in Shasta, and Tehama, Butte, Glenn, Colusa, Sutter and Yolo Counties.
ERP-97-N03b	Sacramento River Floodplain Acquisition and Riparian Forest Restoration The Wildlife Conservation Board/Dept. of Fish and Game actively restored 93 acres of flood-prone agriculture lands to native riparian forest along the Sacramento River between Keswick and Verona. This project increased shaded riverine aquatic habitat and improved degraded instream aquatic conditions. In addition, bird monitoring indicated the restored areas have dramatically improved existing riparian areas for bird usage.	11/1/2002	\$512,500	Complete. Beehive Bend (River mi 169.5), 65.5 acres restored/converted from agricultural land to riparian. Thomas Unit (River mile 166.5) 27.2 acres restored/converted from agricultural land to riparian.
ERP-97-N04	Sacramento River Meander Restoration Project acquired 94.55 acres of agricultural land and restored natural floodplain and river meander to the site. Goals include: Increase extent of channel meander and flood zones, mapping of aquatic and terrestrial habitats, increasing native riparian growth and reducing exotic distribution adjacent to the river.	2/25/2001	\$898,700	Complete. Restored a 10-acre portion of it to riparian habitat. The remaining acres can still be farmed at owner's risk. (Prune Orchard)
ERP-97-N06	Butte Creek Riparian Protection and Restoration Project This project provides a portion of the funds for the acquisition of the McAmis Property, development of a management plan for the Ecological Preserve, and incorporation of the site into the Butte Creek Education Project.	12/31/2001	\$187,128	Complete. Acquired 93.40 acres of riparian.
ERP-97-N07	Cottonwood Creek Channel Restoration Planning/Geomorphic Analysis Geomorphic and hydrologic analyses and re-surveys of historic data to document geomorphic trends along lower Cottonwood Creek. Funded the initial phases for research, planning and design development for restoration of streambank habitat on lower Cottonwood Creek.	11/1/2002	\$61,000	Complete.
ERP-97-N09	Delta Toxicity Monitoring Project, Effects on Anadromous and Estuarine Species Developed comprehensive monitoring program, including quarterly monitoring of Delta back sloughs, to better understand the distribution, residency, and sources of toxic pollution.	11/10/1999	\$100,000	Complete. Final Report in ERP Database.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-97-N12	Franks Tract State Recreation Area Wetlands Habitat Restoration Conducted planning and preliminary engineering for the restoration of deeply flooded habitat to 45 acres of tidal perennial aquatic, shaded riverine aquatic, and mid channel island shoal and shoal habitats in Frank's Tract State Recreation Area (SRA). The tasks included were permitting, environmental compliance, final design and other preconstruction planning.	12/31/2002	\$293,052	Complete.
ERP-97-N20	Implementing Programs to Reduce the Use of Pesticides and Fertilizers in Sacramento and San Joaquin Watersheds, BIOS/LFN Strategy Increased awareness of farmers to detrimental impacts of synthetic chemicals and demonstrate possible mitigation approaches.	6/30/2001	\$1,680,631	Complete.
ERP-97-N21	Knights Ferry Gravel Replenishment Evaluated the effects of adding different sizes and sources of gravel on the utilization of spawning habitat by fall-run Chinook salmon and the quality of incubation habitat at 18 project sites in the Lower Stanislaus River.	3/15/2002	\$561,407	Complete. Restored spawning habitat for fall-run Chinook salmon, by adding 13,000 tons of gravel to the streambed, distributed among the 18 sites between Goodwin Dam and Oakdale (RM 40).
ERP-98-A02	Habitat Restoration/Flood Control Bypasses System Evaluated restoration needs and opportunities to improve habitat, reduce stranding and improve connectivity with the Sacramento River and the north Delta.	12/31/2002	\$947,2260	Complete.
ERP-98-B03	Fish Passage Improvement Project under Bay Delta Project - Category III Consisted of the planning phase for construction of fish passage improvement structures at the Anderson-Cottonwood Irrigation District main diversion dam for the benefit of anadromous fish.	3/31/1999	\$325,000	Complete.
ERP-98-B09	Integrated Pest Management Partnership to Improve Water Quality in Suisun Bay and Local Creeks Increased awareness of users to detrimental impacts of the use and disposal of pesticides and provide education and outreach of integrated pest management (IPM) improve water quality in the Suisun Bay and local creeks.	10/31/2001	\$273,276	Complete.
ERP-98-B10	Cat Creek Watershed Project, Review of the Forest Road System for Repair, Relocation or Obliteration Developed a watershed restoration plan to reduce erosion in the Cat Creek Watershed.	6/30/2000	\$38,000	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-B11	Lower Mokelumne River Restoration Plan - Phase 1 Completed the preliminary work necessary to allow the future construction of fish passage improvements and fish screens at Woodbridge Dam on the Lower Mokelumne River.	2/5/2002	\$1,920,000	Complete.
ERP-98-B16	Reconnaissance Investigation and Preliminary Design for Steelhead and Winter-run and Spring-run Chinook Passage Facilities Represented the planning and preliminary design phase for the improvement of anadromous fish passage on Battle Creek through analysis of five sites for construction of fish screens and ladders.	6/30/2001	\$395,000	Complete.
ERP-98-B22	Fish Passage Improvement Project at the Red Bluff Diversion Dam Provided funds for identifying the best alternative for operation of the Red Bluff Diversion Dam that maximizes fish passage for anadromous fish while minimizing adverse impacts to agricultural irrigation supply.	2/28/2000	\$340,164	Complete.
ERP-98-B23	Steelhead and Chinook Salmon Fish Passage Barrier Remediation on the Guadalupe River Increased upstream passage of returning steelhead and Chinook salmon adults on the Guadalupe River by constructing fish passage structures past two diversion facilities.	12/31/2001	\$178,200	Complete.
ERP-98-B24	Fish Passage and Fish Screening Improvement Project, Phase II Provided funds for completing the final design, environmental documentation, and permitting for improved fish passage structures on the Anderson-Cottonwood Irrigation District diversion dam on the Sacramento River.	8/31/1999	\$840,759	Complete.
ERP-98-B35	The Butte Creek Watershed Educational Workshops and Field Tours Series Provided funds to support the efforts of the Butte Creek Watershed Project (BCWP) to create education workshops and outreach materials focused on watershed issues. This project included 13 workshops/field tours held over the course of eighteen months.	12/31/2002	\$32,276	Complete.
ERP-98-C03	Hamilton Wetlands Restoration Planning Planning and environmental documentation for the restoration of 2,500 acres of subsided, diked baylands to a mix of seasonal and tidal wetlands.	6/30/2002	\$1,070,030	Complete.
ERP-98-C04/C05	Basso Bridge Ecological Reserve and Merced River Ranch Land Acquisitions Protected spawning riffles, and protected and enhance riparian species. This project was to acquire 318 acres along the Merced River near Snelling, and 39 acres along the Tuolumne River near La Grange, for the protection of riparian, wetland and riverine habitats.	12/31/2000	\$830,500	Project was able to acquire 318 acres at the Merced River Ranch and three of the four Basso Bridge sites. The remaining parcel owner was unwilling to sell.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP Implementation of monitoring and applied research that provides data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.
ERP-98-C11	Adult Fall-Run Chinook Salmon Movement in the Lower San Joaquin River and South Delta Evaluated adult Chinook migration and delays through the lower San Joaquin River and South Delta to determine the effects of the South Delta Temporary Barriers, Head of Old River Barrier, and/or low DO conditions.	5/31/2001	\$285,000	Complete.
ERP-98-C13	Spawning Areas of Green Sturgeon in the Upper Sacramento River Characterized green sturgeon habitat and life history patterns in the upper Sacramento River for the purpose of providing information useful to restoration and management activities in the area.	1/31/2002	\$60,801	Complete.
ERP-98-C14	Monitoring Adult and Juvenile Spring and Winter Chinook Salmon and Steelhead in Battle Creek, California Monitored salmon and steelhead in Battle Creek to obtain life history information to assess the current health of the habitat and provide an evaluation tool for restoration activities.	8/31/2002	\$150,000	Complete. Project monitored adult and juvenile spring- and winter-run Chinook salmon and steelhead in Battle Creek in order to obtain life history information.
ERP-98-C15	Biological Assessment of Green Sturgeon in the Sacramento-San Joaquin Watersheds Investigated green sturgeon's biological requirements, such as food and oxygen requirements at different water temperatures, swimming performance, larvae and fry development needs, and the effects of stressors on reproductive functioning.	10/31/2001	\$241,000	Complete.
ERP-98-C17	Assist in Developing Appraisal & Planning with TNC for the McCormack-Williamson Property The California Department of Water Resources provided services and support for the acquisition and initial site planning for the McCormack-Williamson Tract, including an appraisal, a legal transaction review, and initial planning activities.	11/30/2001	\$24,000	Complete.
ERP-98-C19	Conduct/Facilitate Meetings on the Upper Yuba River, Engelbright Dam USFWS coordinated & facilitated meetings designed to gain agreement on the initial components of a study plan, to evaluate the feasibility of restoring anadromous fish runs above Engelbright Dam on the Yuba River.	12/30/1999	\$7,333	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-E01	Napa River Watershed Stewardship Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/31/2000	\$250,000	Complete.
ERP-98-E02	Sonoma Creek Watershed Enhancement Plan - Phase II Assisted in implementing restoration, monitoring, and educational outreach actions in the Sonoma Creek Watershed aimed at restoring the watershed through collaboration with a combination of public and private organizations.	12/31/2000	\$302,000	This project succeeded in replanting more than 2000 linear feet of riparian zone and extending stream setbacks to 200 feet on some private property. Capacity building was also enhanced through planning and outreach including BMPs and Invasive species issues.
ERP-98-E03	San Francisco Bay Area Wetlands Ecosystem Goals Project Enabled the collection of data to be use in the creation of habitat goals to be used by private, local, state, and federal entities seeking to protect and improve the San Francisco Bay Area's wetlands.	3/31/1998	\$76,000	Complete.
ERP-98-E07	Local Watershed Stewardship: Steelhead Trout Plan, Corte Madera Creek Watershed, Marin County, California Developed a steelhead restoration plan for the Corte Madera Creek as part of a larger watershed management plan for the Corte Madera Creek watershed.	12/31/2000	\$47,500	Complete.
ERP-98-E09	Merced River Corridor Restoration Plan - Phase II Analyzed and quantified current in-channel, riparian, and floodplain conditions in the Merced River Corridor.	3/23/2001	\$345,443	Complete.
ERP-98-E11	Watershed Restoration Strategy for the Yolo Bypass Facilitated broad based local stakeholder group in development of watershed plan.	3/31/2002	\$287,353	Complete.
ERP-98-E12	Lower Mokelumne River Watershed Stewardship Program (Phase I) Facilitated broad based local stakeholder group in development of watershed plan, develop Environmental Farm plan and expand neotropical bird monitoring for the Mokelumne River Watershed.	9/1/2000	\$159,000	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-E14	American River (North and Middle Forks) Integrated Watershed Plan and Stewardship Strategy Developed a Watershed Management Plan and Stewardship Strategy to address a wide range of environmental, institutional, social, and economic issues for the watershed encompassing the North and Middle Forks of the American River.	12/31/2002	\$220,750	Complete.
ERP-98-E15	Sulphur Creek Coordinated Resource Management Planning Group Provided funds to support the ongoing efforts of the Sulphur Creek Coordinated Resources Management Planning Group, which is a broadbased local stakeholder group that works to implement restoration activities in the watershed.	5/10/2001	\$23,828	Under this grant, the Sulphur Creek CRMP distributed a watershed analysis, developed community-based restoration objectives, pursued funding to implement projects identified in the Watershed Analysis, and enhanced public awareness and education in fisheries and watershed issues.
ERP-98-E16	Lower Putah Creek Watershed Stewardship Program Developed a community-based watershed stewardship program from lower Putah Creek through a collaborative process involving stakeholders, landowners, state and federal resources agencies, and local groups.	3/31/2002	\$100,500	Complete.
ERP-98-F01	Butte Creek Watershed Coordinator Assistant, Education Project, Road Survey Project, Geomorphology Analysis, and Restoration Implementation Combined the tasks from four proposals submitted during the 1997 PSP year; provided funds for an assistant watershed coordinator; developed the Butte Creek Watershed Education Project; funded the Butte Creek Watershed Road Survey; and provided for a Geomorphology Analysis of Lower Butte Creek.	12/30/2001	\$302,745	Complete.
ERP-98-F03	Butte Creek Acquisition and Riparian Restoration Acquired and restored riverine habitat adjacent to spawning and holding pools in Butte Creek to provide an opportunity to develop and demonstrate methods of channel and floodplain management that would help stabilize the sediment from the remains of the gravel mining operations.	1/11/2002	\$186,128	Complete. Acquired and conducted planning for stream length 93 acres/0.75 miles (Butte Creek Ecological Preserve, Honey Run Unit). Habitats: riparian, wet meadow, annual grassland, gray pine, SRA, oak woodlands
ERP-98-F07	Grayson River Ranch Perpetual Conservation Easement and Restoration Provided a perpetual conservation easement on 140 acres, returning historic floodplain to the river, restoring critical riparian habitat, and providing greater flexibility with flood management.	10/31/2007	\$582,000	Complete. Also restored 26.5 acres to riparian and riverine aquatic – riparian habitat.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-F08	Hill Slough West Habitat Restoration Demonstration Project Completed the topographic surveys, hydrological evaluation, conceptual restoration plan, and monitoring plan for a multi-phased project to restore tidal action to seasonal and permanent wetlands in the Suisun Marsh at Hill Slough.	5/30/2002	\$200,000	Complete.
ERP-98-F11	Merced River Salmon Habitat Enhancement - Phase III (Robinson Reach) Eliminated predator habitat. Improved spawning and rearing habitat. Replanted riparian vegetation. Restored natural conditions to Merced River habitat at river miles 42 to 43.5. Filled/isolating deep pools, reconfigured channel and floodplain characteristics, and increased riparian habitat.	9/30/2002	\$2,433,000	Complete.
ERP-98-F15	Lower Clear Creek Floodway Restoration Project (Phase II) Improved salmon spawning and rearing habitat by implementing the Lower Clear Creek Watershed Management Plan and restoring 2.9 miles of floodplain and riverine aquatic habitat.	6/30/2006	\$4,561,940	Complete. Reported 35.9 acres restored to riparian. 1997-2000 annual gravel augmentation 24,000 tons.
ERP-98-F17	Benicia Waterfront Marsh Restoration Project Phase 1, final planning and permitting for the restoration of 8 acres of degraded salt marsh habitat along the Benicia waterfront in downtown Benicia for the benefit of several important plant and animal species.	2/28/2001	\$59,000	Complete.
ERP-98-F18	Floodplain Acquisition, Management, and Monitoring on the Sacramento River Acquired (via title or easement) flood-prone lands adjacent to the Sacramento River between Keswick and Verona with the purpose of protecting and improving essential spawning, rearing, and migratory habitat for Chinook salmon and other riparian species, as well as supporting the river's natural ecological processes.	9/30/2002	\$1,000,000	Complete. Acquired 106 acres.
ERP-98-F23	South Napa River Tidal Slough and Floodplain Restoration Project First phase in restoring over 460 acres of wetlands in the South Napa River Tidal Slough. Funded acquisition of the property, preliminary design work, an environmental feasibility study, and an environmental compliance document.	6/30/2001	\$1,480,000	Complete. Acquired 453.24 acres. Habitats include: tidal perennial aquatic, saline emergent wetland, sloughs, seasonal wetlands, and perennial grasses.
ERP-98-F24	Butte Creek Riparian Restoration Demonstration Restored the Virgin Valley Ecological Preserve by eliminating unauthorized vehicle access, providing over 6000 feet of walking trails, restoring damaged areas, and providing educational materials and signage at the site.	9/30/2002	\$76,348	Complete. Enhanced habitat by planting willows on top of riprap, 0.05 miles of stream length.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-N02	Expanding California Salmon Habitat through Non-Governmental and Non-Regulatory Mechanisms to Alter Dams and Diversions Inventoried dams and diversions in the Central Valley and developed a mechanism to purchase dams and diversions from willing sellers to improve fish passage.	3/15/2000	\$49,000	Complete.
ERP-99-B01	Battle Creek Salmon and Steelhead Restoration Project Will restore 42 miles of habitat for anadromous fish and improve water quality for the Coleman National Fish Hatchery in the Battle Creek Watershed by decommissioning several PG&E diversion dams, providing fish ladders and screens for those that remain, and increasing instream flows for fish.	Unknown	\$27,200,000	Ongoing.
ERP-99-B02	Lower Butte Creek Project (Phase II: Preliminary Engineering and Environmental Analysis for Butte Sink Structural Modifications and Flow-Through System) Phase II of the Lower Butte Creek Project to improve fish passage through the Butte Sink and its associated water control structures by selecting the preferred alternative for design of major structural modifications at structures throughout the Butte Sink.	6/30/2002	\$900,000	Complete.
ERP-99-B07	Fish Passage Improvement at the Red Bluff Diversion Dam, Phase II Provided funds for a portion of Phase II of the Tehama-Colusa Canal Fish Passage Project at Red Bluff Dam, which involved modifying the Red Bluff Diversion Dam (RBDD) to reduce or minimize the impacts of the RBDD on upstream and downstream migration of juvenile and adult anadromous fish migration. The remainder of Phase II was funded under ERP-01-N58.	3/31/2002	\$1,839,888	Complete.
ERP-99-B08	Improve Upstream Ladder and Barrier Weir at Coleman National Fish Hatchery at Battle Creek Will improve the fish ladder at the Coleman National Fish Hatchery barrier weir and modify the barrier weir to repair existing damage that will assist management in restoring fish populations on Battle Creek.	12/31/2009	\$9,326,820	Ongoing.
ERP-99-B10	Species and Community Profiles Report of the San Francisco Bay Area Wetlands Ecosystem Goals Project Funded the completion of the Species and Community Profiles Report as part of the Goals Project to provide information on over 97 species of plants and animals providing scientific information on species needs, distribution, life history, and population trends.	9/30/2001	\$30,614	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-B11	South Napa River Tidal Slough and Floodplain Restoration Project Phase 2 of the South Napa River Tidal Slough and Floodplain Restoration Project, which involved the restoration of tidal flow to 2.3 miles of historic slough habitat, and the restoration of nearly 483 acres of wetlands and uplands.	9/30/2005	\$1,520,000	Complete. Original and new habitats: perennial grasslands, saline emergent wetland, tidal perennial aquatic, tidal sloughs and seasonal wetlands.
ERP-99-B12	Riparian Corridor Acquisition & Restoration Assessment Project Protected critical habitat through conservation easements and fee title acquisitions, and provided a foundation for ecosystem restoration specific to the project area. Approximately five miles of Sacramento River frontage, 4.5 miles of Battle Creek frontage, and 3 miles of Sacramento River (river mile 271-274) frontage preserved. Acquisition and assessment only.	4/30/2003	\$2,052,237	Complete. Protected 3 miles of riparian and 1,412 acres of multiple habitats along the Sacramento River. Protected 4.5 miles of riparian and 100 acres of multiple habitats along Battle Creek.
ERP-99-B13	Understanding Tidal Marsh Restoration Processes and Patterns: Validating and Extending the "BREACH" Conceptual Model Addressed considerable uncertainty in predicting the outcome and ecological benefit of restoring shallow-water tidal habitat in three different regions of the Bay Delta: the Delta, Suisun Bay, and San Pablo/North Bay.	6/30/2004	\$1,093,292	Complete. Refinement of conceptual models.
ERP-99-C01/C02	East Delta Corridor Habitat Studies: Cosumnes and Mokelumne Rivers Feasibility Study Feasibility Study of Ecosystem Restoration opportunities on the lower Cosumnes and Mokelumne Rivers.	6/30/2007	\$1,007,800	Complete.
ERP-99-N01	ACID Fish Passage Improvement Project, Phase III Provided funds for construction of improved fish passage structures on the Anderson-Cottonwood Irrigation District diversion dam on the Sacramento River.	9/1/2002	\$5,100,000	Complete.
ERP-99-N02	Fish Treadmill Developed Fish Screen Criteria for Native Sacramento-San Joaquin Watershed Fishes Provided the data necessary to develop the "proven technology" for protective positive barrier fish screens for priority native fishes in the Sacramento-San Joaquin watershed.	3/31/2002	\$1,069,750	Complete.
ERP-99-N08	Assessment of Pesticide Effects on Fish and their Food Resources in the Sacramento-San Joaquin Delta An integrated laboratory and field study with the objectives of providing information on pesticide toxicity to resident species in the Sacramento-San Joaquin Delta, developing the data needed to apply laboratory-derived toxicity measures to realistic field conditions, and putting results in an ecological context focusing on juvenile Chinook salmon and their prey.	8/01/2004	\$1,706,670	Complete.

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-N14	Colusa Basin Watershed Project A watershed management project to assist private landowners in addressing non-point source pollution, flood control issues, exotic invasive weed abatement, and reactivating important ecological processes and functions of riparian corridors in the Colusa Basin Drain watershed.	11/6/2005	\$492,500	Complete. Created ponds, planted riparian areas, provided exclusion fencing, irrigation systems, halting erosion.
ERP-99-N15	Lower Mokelumne River Watershed Stewardship Plan Program (Phase II/III) Continuation of a previously funded project by completing preparation of the Lower Mokelumne River Watershed Stewardship Plan/Watershed Owner's Manual, Action Plan, and Monitoring and Evaluation Program and implemented the Initial Watershed Stewardship Actions.	06/30/2002	\$227,000	Complete.
ERP-99-N17	Yuba Watershed Council: A Collaborative Approach Supported the ongoing efforts of the Yuba Watershed Council (YWC) by funding a watershed coordinator, materials, equipment, and office space to provide coordination and assistance, adaptive management and monitoring, education and outreach, and continuity and program oversight of current and future watershed projects.	6/30/2003	\$142,618	Complete.
ERP-99-N18	Geomorphic Model for Demonstration and Feasibility Assessment of Setback Levees: Bay-Delta River Systems Developed a geomorphic model that allows simulation and demonstration of the response of riverine systems to levee removal and setback. Developed levee and infrastructure-placements component of this migration model; applied the model to simulate levee setback scenarios; developed interactive computer visualization of model output; and prepared model simulations, report and recommendations.	6/11/2004	\$104,458	Complete.
ERP-99-N19	American River (South and Middle Fork) Watershed Stewardship Project Produced a Watershed Management Plan and Stewardship Strategy for the South and Middle Forks of the American River to serve as a tool for implementing restoration activities on the river.	5/15/2004	\$253,738	Complete.
ERP-99-N20	Napa River Watershed Stewardship Year 2 Built upon work in the Napa River watershed by continuing to address a broad range of ecological and biological issues relating to habitat restoration for anadromous fish and other priority species by promoting collaborative watershed stewardship.	12/30/2001	\$191,100	Complete. Hydrologic modeling. Multiple habitats enhanced. Eroding bank stabilization, Himalayan blackberry eradication, riparian enhancement and revegetation, spawning habitat improvement (0.05 stream miles, 0.25 acres).

Table 1. Essential Fish Habitat Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-N21	Development of a River corridor Management Plan for the Lower American River Developed a River Corridor Management Plan for the lower American River between the Sacramento River and the Nimbus Dam in Sacramento County to serve as a planning framework and consensus-building process for pursuing CALFED's vision and objective for ecosystem restoration along the American River.	4/1/2002	\$250,000	Complete.
IMM-02-I01	Battle Creek Protection and Stewardship Purchased conservation easements, fenced and restoration of creek sides and other sensitive habitats, and monitored habitat on three ranches in the Battle Creek watershed.	Unknown	\$2,206,625	Ongoing. Contracted to acquire by conservation easement Lazy R Bahr Ranch (3,000 acres, 2 stream miles) and Wildcat Ranch (1,844 acres, 2-stream miles). Reported acquisition of McCampbell Ranch (2,007 acres, 2 stream miles). Multiple habitats including riparian listed for each property.

Other Programs Contributing to ERP Vision

Implementation of the Central Valley Project Improvement Act (CVPIA) by the U.S. Fish and Wildlife Service (USFWS) and the Bureau of Reclamation (Reclamation) is another key program that provided for a variety of habitat restoration projects within the CALFED area including restoration of EFH.

These include

- Improving instream flows in Clear Creek, Sacramento River, American River and Stanislaus Rivers.
- Placing 151,000 cubic yards of gravel on the Sacramento, Stanislaus and American Rivers since 1997, to create anadromous fish spawning habitat.
- Restoring Clear Creek by removing McCormick-Saeltzer Dam in 2000, restoring 1.6 miles of stream channel as of 2007, and placing spawning gravel since 1995 to create anadromous fish spawning habitat.

Planned Projects for Implementation

Several ERP projects have funded various phases for Battle Creek restoration. *Battle Creek Chinook Salmon and Steelhead Restoration Plan (ERP-96-M12)* collected data to create a watershed plan as part of the overall watershed strategy used for

implementing the Battle Creek Salmon and Steelhead Restoration Project. Anadromous Fish Habitat Monitoring for the Battle Creek Salmon & Steelhead Restoration (**ERP-06D-S18**) will implement Anadromous Fish and Habitat Monitoring for the Battle Creek Salmon and Steelhead Restoration Project. Actual implementation for the overall project is still awaiting approval.

Two monitoring projects will benefit fish habitat by making it possible to arrive at best management practices in the future. *Development of a Central Valley Steelhead Comprehensive Monitoring Plan* (**ERP-05D-S05**) will be a comprehensive plan for steelhead population monitoring that, when implemented, will provide the data necessary to assess whether or not restoration and recovery goals are being achieved and improve management of the species. The *Clear Creek Anadromous Salmonid Monitoring Program* (**ERP-04-S16**) is a comprehensive salmonid monitoring program that will provide feedback for the adaptive management and evaluation of restoration actions of the Clear Creek Restoration Program and B2 Water Program.

Status of Topic Today

Actions to improve the condition of EFH will continue in the future primarily through multi-objective projects that include efforts to improve anadromous fish passage, replenish stream sediments, especially spawning gravel, and improve floodplain-stream interactions.

Impediments to Implementation

None.

References

- CALFED Bay-Delta Program. 2000a. Ecosystem Restoration Program Plan - Volume I: Ecological Attributes of the San Francisco Bay-Delta Watershed. Final Programmatic EIS/EIR Technical Appendix. Sacramento, CA.
- CALFED Bay-Delta Program. 2000b. Ecosystem Restoration Program Plan - Strategic Plan for Ecosystem Restoration. Final Programmatic EIS/EIR Technical Appendix. Sacramento, CA.
- Federal Register. 2002. Magnuson-Stevens Act Provisions; Essential Fish Habitat (EFH). Final rule. 50 CFR 600: FR. 67(12) Jan. 17, 2002.
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- Pacific Fishery Management Council (PFMC). 1999. Amendment 14, Appendix A: Identification and Description of Essential Fish Habitat, Adverse Impacts, and Recommended Conservation Measures for Salmon (August 1999).
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4. HABITATS

4.11. Inland Dune Scrub

Introduction

Inland dune scrub is associated with inland sand dunes, and is limited in the ERPP focus area to the vicinity of the Antioch Dunes National Wildlife Refuge. This habitat area supports two plant and one butterfly species listed as endangered under the federal Endangered Species Act. Major factors that affect this habitat are related to adverse effects of sand mining, dune conversion to other land uses, dune stabilization, and land use practices that maintain the dominance of non-native plants.

Applicable ERP Vision

The vision for inland dune scrub habitat is to protect and enhance existing areas and restore former habitat areas. Achieving this vision will provide high-quality habitat for associated special-status plant and animal populations.

Stage 1 Expectations

None.

Changes Attributable to ERP

Dutch Slough Tidal Marsh Restoration Project (Phase I) (ERP-02-C07-D) and *Dutch Slough Restoration Project (ERP-02-P03-D)* propose to restore 110 acres of Antioch Dune Scrub (Inland Dune Scrub). The acquisition of the 1,166 acre parcel has been completed. Restoration activities have not yet begun.

Project Summary Table

Table 1. Inland Dune Scrub Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-C07-D	Dutch Slough Tidal Marsh Restoration Project (Phase I) This project was Phase 1, which included acquisition and site management, of a three phase project. This project acquired the three contiguous parcels totaling 1,166 acres that comprised the Dutch Slough site.	12/31/2006	\$23,550,000	Complete.
ERP-02-P03-D	Dutch Slough Restoration Project The purpose of this project was to develop a restoration plan for a 1,166 acre site adjacent to Dutch Slough and the mouth of Marsh Creek in the western Delta.	11/2/2007	\$1,500,000	Complete.
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP CMARP is an adaptive management strategy as a process for implementing proposed changes and ongoing activities to many aspects of the Bay-Delta/Central Valley environment and water management system. CMARP provides information and scientific interpretations necessary for program implementation and to judge the Program's success. CMARP provides information on all of the CALFED program elements and contributes to the mitigation design. The project implemented monitoring and applied research that provided data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.

Other Programs Contributing to ERP Vision

The USFWS (2002) completed a Comprehensive Conservation Plan (CCP) for the Antioch Dunes National Wildlife Refuge. The USFWS prepared this CCP to guide wildlife and other natural resource management, including public use, on the refuge for the next 15 years (starting in 2003). The CCP will be revised periodically to ensure that its goals, objectives, implementation strategies, and timetables are still valid and appropriate. Major revisions will require public involvement and National Environmental Policy Act (NEPA) review, if needed. The CCP identifies actions to be taken for weed control, restoration, outplanting, monitoring, firebreaks, riparian restoration, land protection, and public use.

Status of Topic Today

The Antioch Dunes were once a large, ancient, Aeolian (wind blown) dune system extending along the southern bank of the San Joaquin River just east of the town of Antioch. According to a 1908 U.S. Geological Survey Topographic map the bulk of the dunes were along a two-mile stretch of the river, averaged approximately one-sixth of a mile wide and totaled roughly 190 acres (USFSW 2002). Today approximately 67 areas are managed by USFWS for the protection of Antioch Dune species (USFWS 2002). The amount protected/managed remains the same today. Three endangered species, Lange's metalmark butterfly (*Apodemia mormo langei*), Contra Costa wallflower (*Erysimum capitatum* var. *angustatum*), and Antioch Dunes evening primrose (*Oenothera deltoides* ssp. *howellii*), that inhabit Antioch Dune Scrub (Inland Dune Scrub) continue to be endangered.

Planned Projects for Implementation

If the Dutch Slough Tidal Marsh Restoration Project is implemented, the total protected/restored dune scrub habitat could reach approximately 177 acres, approximately 93% of the original habitat.

Impediments to Implementation

None.

References

- CALFED Bay-Delta Program. 2000. Ecosystem Restoration Program Plan - Volume I: Ecological Attributes of the San Francisco Bay-Delta Watershed. Final Programmatic EIS/EIR Technical Appendix. Sacramento, CA.
- U.S. Fish and Wildlife Service (USFWS). 2002. Antioch Dunes National Wildlife Refuge Comprehensive Conservation Plan. Sacramento, CA.

4. HABITATS

4.12. Perennial Grassland

Introduction

Perennial grasslands provide important breeding and foraging habitat areas for many wildlife species and support several special-status plant species. This habitat type was historically common throughout the Central Valley. Most perennial grassland has been lost or converted into annual grassland. Major factors that affect this habitat and its contribution to ecosystem health include the conversion of perennial grassland to agricultural, urban, and industrial uses; and ongoing land use practices that maintain non-native annual grassland dominance in historically perennial grassland habitat.

Applicable ERP Vision

The vision is to protect and improve existing perennial grasslands and increase perennial grassland area to provide high-quality habitat for special-status plant and wildlife populations, as well as other wildlife dependent on the Bay-Delta.

Stage 1 Expectations

The Stage 1 expectation was to develop a classification system for Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay habitats that can be used as a basis for conservation actions. Specific, numeric objectives were to be formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. Within and among habitat types, conservation and restoration activities were to be prioritized. Work on those projects given highest priority was to begin within a year of adoption of the strategic plan.

Changes Attributable to ERP

Restoring Ecosystem Integrity in the Northwestern Delta - Jepson Prairie Restoration and Habitat Conservation Plan (ERP-97-N10) restored habitat along two northwest Delta sloughs and adjacent perennial grasslands at Jepson Prairie. The project converted 507 acres of agricultural grazing land to perennial grassland, as well as removed eucalyptus trees and implemented prescribed burning to control weeds. 500 ft were fenced along the bank of Calhoun Cut, and native plants were planted in order to restore riparian habitat and enhance Delta Sloughs. The *Restoring Ecosystem*

Integrity in the Northwest Delta: Phase II (ERP-02D-P54 and ERP-02-P21) projects will acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey, and Calhoun Sloughs, and north Delta tidal channels located west of the Yolo Bypass. The projects' goals are to manage and restore up to 1300 acres of perennial grassland/vernal pool complex in Solano County, and develop a management plan for the Pembco property or other acquisition within the Jepson Prairie Preserve (JPP) Island Corridor. Planning, outreach, and experimental treatment plots to determine restoration methods for 1,350 acres of various habitats (primarily perennial grasslands and vernal pools) are also included.

Through the project *Stone Lakes NWR Land Acquisition (ERP-98-F12)*, the Stone Lakes National Wildlife Refuge acquired fee title on approximately 537.35 acres of land within the boundary of the Refuge. The project was designed to protect existing aquatic, wetland, and riparian habitats. It also restored a mosaic of aquatic, perennial and seasonal emergent wetland, riparian, and grassland habitats. The actual amount of perennial grassland has not been documented.

Along the Cosumnes River, more than 2,000 acres of land (of which an unspecified amount is perennial grassland) has been protected, enhanced, and/or restored through the *Cosumnes Start-up Stewardship and Restoration (ERP-97-N14)*, *Cosumnes Floodplain Acquisition and Restoration (ERP-98-B17)*, and *Cosumnes River Floodplain Acquisition, Restoration Planning, and Demonstration (ERP-98-F19)* projects.

Located in the Yolo Basin EMZ, the *Union School Slough Watershed Improvement Program (ERP-98-E13)* and *Willow Slough Watershed Rangeland Stewardship Program (ERP-01-N31)* projects assisted landowners with conservation practices and formed a landowner stewardship group for information sharing, problem-solving, and "neighbor-convincing." Conservation activities included restoring upper watershed riparian areas and rangelands. The first project enhanced over 1,190 acres of multiple habitats, which included perennial grassland. The second project accomplished a prescribed burn on 1,429 acres, and enhanced 1,005 acres of native perennial grassland.

Project Summary Table

Table 1. Perennial Grassland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-F08	McCormack-Williamson Tract Restoration Planning, Design and Monitoring Program I This project performed baseline studies necessary for project planning and design, and the development of long-term monitoring programs of the McCormack-Williamson Tract (M-W), which is a 1,600-acre Delta island.	8/1/2003	\$556,200	Complete.
ERP-01-N30	Digital Soil Survey Mapping and Digital Orthophotoquad Imagery Development This project made soils information more accessible to individuals and groups engaged in ecosystem restoration projects in the Bay-Delta Region, and in doing so, improved the responsiveness of these projects to established habitat and supported sustainable populations of valuable species.	8/15/2004	\$430,390	Complete.
ERP-01-N31	Willow Slough Watershed Rangeland Stewardship Program This project was built on restoration efforts in the Willow Slough watershed to enhance and restore riparian and grassland habitats, improve forage quality, improve water quality, and reduce erosion. Project accomplished the following: 1,429 acres prescribed burning, 1,005 acres native perennial grassland, 4.4 miles/105.7 acres riparian fencing, 4 erosion control projects utilizing bioengineering techniques, 7 stock ponds wildlife enhancement projects.	12/31/2005	\$1,800,668	Complete. www.plantbiology.msu.edu/malmstrom/Audubon/index.htm
ERP-02D-P54	Restoring Ecosystem Integrity in the Northwest Delta: Phase II This project proposes to acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, north Delta tidal channels located west of the Yolo Bypass. Acquisition of conservation easements will be on 1,100 acres of existing riparian, wetland and/or agricultural lands. Currently in the process of acquiring an agricultural easement on 292 acres.	8/31/2008	\$1,781,658	Ongoing
ERP-02-P21	Restoring Ecosystem Integrity in the Northwest Delta: PHASE II The project's goal is to manage and restore up to 1300 acres of perennial grassland/vernal pool complex in Solano County, CA, and develop a management plan for the Pembco property or other acquisition within the JPP Island Corridor.	8/31/2008	\$246,370	Ongoing.

Table 1. Perennial Grassland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-02-P49	Deer Creek Hills Project Entire project was purchased 4,000+ acres in the foothill region of the upper Cosumnes River watershed. A portion of the project acquired 294 acres of the Deer Creek Hills property. The site featured blue oak woodland, vernal pools, 294 acres of the Deer Creek Hills property was acquired 8/14/03 by the Sacramento Valley Conservancy and the County of Sacramento. Contained seasonal wetlands - vernal pools; perennial grassland, riparian and riverine aquatic - riparian; agricultural land - grazing; blue oak savannah.	3/31/2004	\$800,000	Complete.
ERP-97-N10	Restoring Ecosystem Integrity in the Northwestern Delta - Jepson Prairie Restoration and Habitat Conservation Plan Restored habitat along two northwest Delta sloughs and adjacent perennial grasslands at Jepson Prairie. Converted 507 acres of agricultural grazing land to perennial grassland. Removed eucalyptus trees and prescribed burning of weeds. Fenced 500 ft along the bank of Calhoun Cut and planted native plants to restore riparian and enhancing Delta Sloughs.	9/30/2002	\$292,801	Complete.
ERP-97-N14	Cosumnes Start-up Stewardship and Restoration Acquired and planned for 2,341 acres of floodplain properties consisted of various habitat types (agricultural land, dairy, oak woodland, grasslands, seasonal wetlands). Included clean-up and repair of the properties in the Eastside Delta Tributaries EMZ.	9/30/2002	\$2,305,730	Complete.
ERP-98-B17	Cosumnes Floodplain Acquisition and Restoration Restored and improved floodplain functions. Restored riparian and wetland vegetation. Supplemental funding for acquisition occurring in project ERP-97-N14	12/31/1998	\$3,500,000	Complete.
ERP-98-B33	Expand Bird Monitoring, Develop a Native Grass Plot, and Enhance Public Involvement with Access to Native Plant Garden Surrounding the Discovery Center Provided a public information/education component of CALFED work to ensure that the improvements on the river and the maintenance of a sustainable, balanced, healthy river system are understood and supported by the general public.	9/30/2001	\$49,640	Complete.
ERP-98-C10	Comprehensive Monitoring Assessment and Research Program - CMARP Implemented monitoring and applied research that provided data and information necessary to evaluate the performance of completed CALFED program actions and ongoing programs.	12/31/1999	\$800,000	Complete.

Table 1. Perennial Grassland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-E11	Watershed Restoration Strategy for the Yolo Bypass The project will coordinate interaction between stakeholders and facilitate the development of a watershed restoration strategy in order to enhance Yolo Bypass habitats. Tasks include identifying and contacting stakeholders, summarizing existing conditions, hold meetings and conduct workshops, and develop a draft plan.	3/31/2002	\$287,353	Complete.
ERP-98-E13	Union School Slough Watershed Improvement Program The Yolo RCD together with Audubon-California enacted portions of the 1996 Willow Slough Integrated Resources Management Plan, which Union School Slough is a part. Developed California's first "service" to assist landowners with conservation practices and formed a landowner stewardship group for information sharing, problem-solving, and "neighbor-convincing." Conservation activities included: 1) restoring upper watershed riparian areas and rangelands; 2) revegetating canals and drainage ditches; 3) constructing wildlife and tailwater ponds; and 4) restoring natural riparian function to the highly altered lower portion of the slough. Multiple habitats (included agricultural land - grazing; riparian and riverine aquatic - riparian) protective fencing, revegetation, controlled burns, seeding and pond construction. 1,190.7 acres.	7/10/2002	\$636,000	Complete.
ERP-98-F12	Stone Lakes NWR Land Acquisition Acquired fee title to approximately 537.35 acres of land within the boundary of the Stone Lakes National Wildlife Refuge to protect aquatic, wetland, and riparian habitats and restored a mosaic of aquatic, perennial and seasonal emergent wetland, riparian, and grassland habitats.	9/30/2003	\$2,626,505	Complete.
ERP-98-F17	Benicia Waterfront Marsh Restoration Project This project will restore approximately 8 acres of degraded salt marsh habitat along the Benicia waterfront located along the Carquinez Straits at the foot of First Street in downtown Benicia. The goals of this restoration project are to reestablish open tidal flows within the marsh area, enhance the overall health and habitat quality of the existing saline emergent wetlands, and provide transitional uplands habitats adjacent to the marsh planted in native grasses.	2/28/2001	\$59,000	Complete.
ERP-98-F19	Cosumnes River Floodplain Acquisition, Restoration Planning, and Demonstration Provided supplemental funding for the acquisition of Denier property that was purchased in project ERP-97-N14. Acquired 475 acres of agricultural land with and included in ERP-97-N14 (Eastside Delta Tributaries EMZ).	9/30/2001	\$750,000	Complete.

Table 1. Perennial Grassland Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-98-F23	South Napa River Tidal Slough and Floodplain Restoration Project This project consists of the acquisition phase. Funding of this project will allow for acquisition of 461 acres of wetlands from the Port of Oakland. Phase 1 tasks include acquisition of the Port of Oakland property, preliminary design work for levee breaches, completion of an environmental constraints study, and completion of CEQA/NEPA documentation and permitting. Phase 2 was funded under ERP-99-B11.	6/30/2001	\$1,480,000	Complete.
ERP-99-B11	South Napa River Tidal Slough and Floodplain Restoration Project This project restored 453 acres of wetlands adjacent to North Slough and the Napa River, from the Port of Oakland (Phase 2). The property was acquired with funding from ERP-98-F23 (Phase 1). Restoration of tidal wetlands was achieved by removal of approximately 30 acres of City of American Canyon-owned sewage ponds, breaching existing levees, restricting cattle grazing, and creating wetlands in upland areas. This project contributed to the restoration of priority habitats, including wetlands and perennial grasslands, and also provided habitat for many target species.	9/30/2005	\$1,520,000	Complete.
ERP-99-B20	Expand Bird Monitoring, Develop a Native Grass Plot, and Enhance Public Involvement with Access to Native Plant Garden Surrounding the Discovery Center Supported educational programs at the Sacramento River Discovery Center that taught students about the complexities of watersheds and the importance of building partnerships to best manage these resources.	12/30/2001	\$38,400	Complete.

Other Programs Contributing to ERP Vision

Since 2001, the Yolo Bypass Wildlife Area has added approximately 13,062 acres, bringing the total managed area to 16,770 acres by 2005. The Yolo Bypass Wildlife Area manages various habitat types, including freshwater emergent wetland, but none is identified as perennial grassland. However, areas that are currently dominated by non-native annual grasses could potentially be restored to perennial grassland (CDFG 2007). Grasslands are found across the majority of the 9,000-acre Tule Ranch unit and in scattered locations within other management units of the Yolo Bypass Wildlife Area (CDFG 2007).

DFG has also created a vegetation classification system for the Delta, Suisun Bay, and Suisun Marsh that helps with the monitoring of conservation actions (Hickson and Keeler-Wolf 2007, Keeler-Wolf and Vaghti 2000).

Status of Topic Today

A classification system for the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay habitats to be used as a basis for conservation actions has been created. Specific, numeric objectives have not been formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. Furthermore, within and among habitat types, conservation and restoration activities have not been prioritized. However, the projects in the Jepson Prairie Region (*Restoring Ecosystem Integrity in the Northwestern Delta - Jepson Prairie Restoration and Habitat Conservation Plan* (**ERP-97-N10**), *Restoring Ecosystem Integrity in the Northwest Delta: Phase II* (**ERP-02D-P54** and **ERP-02-P21**)) have made good progress toward the general target for perennial grassland, which is to protect and restore 4,000-6,000 acres in the Sacramento-San Joaquin Delta EMZ and 1,000 acres in the Suisun Marsh/North San Francisco Bay EMZ.

Planned Projects for Implementation

Fully implementing the project *Restoring Ecosystem Integrity in the Northwest Delta: Phase II* (**ERP-02D-P54** and **ERP-02-P21**) and enhancing the potential habitat in the Yolo Bypass Wildlife Area could easily meet the ERP targets for perennial grassland.

Impediments to Implementation

The very high risk of urbanization within or adjacent to the Delta continues to be a major impediment to grassland restoration in the Delta. Westhoff et al. (2007) developed a comprehensive map of urbanization risk in the Delta. They determined that at least 75,000 acres of land was at very high risk of urbanization within or adjacent to the Delta. In many cases these developments were on deep floodplain and below sea level by up to ten feet (Westhoff et al. 2007).

References

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4. HABITATS

4.13. Agricultural Lands

Introduction

Agricultural lands are located throughout the Central Valley. These lands are comprised of many different types of agricultural land uses, ranging from non-irrigated grazing land to drip-irrigated vineyard. The types of crops grown on any particular parcel are usually dictated by soil type, topography, and availability of water. Intensively managed agricultural lands or croplands are located on flat or slightly rolling terrain. Flat croplands provide more efficient use of water, less soil erosion, and higher crop yields. A variety of fragmented habitats that support resident and migratory wildlife species are closely associated with these agricultural lands and include naturally occurring wetland types, such as creeks, vernal pools, and gullies.

The Central Valley has experienced extensive native habitat loss due to agricultural and urban land conversion. Some wildlife species have adapted to the artificial wetland and upland environments created by agricultural practices. Once adapted, species become dependent on these agricultural areas to sustain their populations. Adverse effects of some agricultural practices are a major factor limiting this resource's contribution to the health of the Bay-Delta. Clean farming practices reduce the availability, quantity, and quality of forage and fence-line vegetation. Converting crops from those that provide relatively high values for wildlife to relatively low-value crop types displaces or insufficiently supports species that have adapted to the habitat. Converting agricultural lands for urban or industrial uses also reduces or eliminates available wildlife habitat.

Agricultural lands can be managed to provide significant habitat benefits for some wildlife species, with crop type and cultivation practices determining the quality of habitat. For example, rice lands support millions of wintering waterfowl using the Central Valley; and lands supporting wheat and corn crops support large populations of wintering waterfowl, as well as the State-listed greater sandhill crane, particularly if the lands have been shallowly flooded after harvest.

Major stressors that affect the value agricultural lands provide for wildlife include methods used in water management; crop conversion (e.g. conversion from pastureland to row crops or vineyards); the use of clean farming techniques such as deep post-harvest disking; practices that reduce crop and grain residue within the field; pesticide application and management; and the timing of all of these activities. All of these common land use practices can limit available habitat for wildlife species, at all life stages, relying on agricultural lands. Using appropriate land use management

techniques, accompanied by reimbursement programs to agricultural stakeholders, can reduce the adverse impacts of these major stressors.

Focusing on production of crop types that provide high wildlife habitat value, encouraging agricultural land and water management practices that increase wildlife habitat value, and discouraging the conversion of ecologically important agricultural lands to urban or industrial uses can all protect and enhance agricultural land for wildlife.

Vegetation management on agricultural lands could provide wildlife habitat in many locations, including rice checks, irrigation ditches, lowlands, ponds, fallow lands, fence rows, and other areas unsuitable for agricultural land use. Agricultural crop types that present excellent opportunities for enhancement include rice, alfalfa, pasture, corn and grain, and certain row crops. Enhancing agricultural lands adjacent to existing wildlife habitat areas, such as refuges, would be particularly beneficial. The value of enhanced land could be increased if nearby non-farmed or fallow lands were managed to provide additional life stage habitats required by wildlife that use agricultural lands. In some situations, altering common management practices can greatly increase wildlife habitat value with little or no change in crop production.

Applicable ERP Vision

The vision for agricultural lands is to improve associated wildlife habitat values to support special-status wildlife populations and other wildlife dependent on the Bay-Delta.

Stage 1 Expectations

The Stage 1 expectations for agriculture lands were to identify high priority agricultural lands and begin the process to acquire easements from willing sellers. Incentive programs were to be developed and implemented to encourage growers to plant crops favored by wildlife and to farm in ways that minimize environmental damage to adjacent areas.

Changes Attributable to ERP

ERP projects are managing 15,980 acres of seasonally flooded agricultural land, which is approximately 4-5% of the ERP target of 353,933-388,933 acres of agricultural land enhancement. ERP has not addressed the one-mile wide corridor proposed for the West San Joaquin Ecological Management Zone (EMZ). The following are ERP accomplishments listed for specific EMZ and Ecological Management Unit (EMU) targets:

- In the Sacramento-San Joaquin Delta EMZ, ERP acquired approximately 11,703 acres; the majority is or will be managed as wildlife-friendly agriculture through the *Staten Island Acquisition (ERP-01-N23)*, *Staten Island Wildlife-Friendly Farming Demonstration (ERP-02-P08)*, *Restoring Ecosystem Integrity in the Northwest Delta: Phase II (ERP-02D-P54)*, *Cosumnes/Mokelumne Corridor Floodplain Acquisitions, Management, and Restoration Planning (ERP-01-N10)*, and *Part A: The McCormack-Williamson Tract Acquisition (ERP-99-F04)* projects. If managed with wildlife-friendly agriculture, then ERP would be approximately 29% of the way to reaching the target of 40,000-75,000 acres.
- In the Sacramento River EMZ, ERP acquired 4,235 acres for wildlife-friendly agriculture through the *Llano Seco Ranch (ERP-05D-S22)* project. However, the exact amount of this total designated as wildlife-friendly agricultural lands is not clear. If the entire amount is managed as such, then it would achieve approximately 4% of the target of 111,285 acres.
- In the Butte Basin EMU, no ERP projects produced wildlife-friendly agricultural lands. A new project, *Rice-Cover Crop Rotation Pilot Program (ERP-05-S27)*, proposes to manage 1,000 acres as wildlife-friendly agriculture. If this goal is reached, approximately 1% of the target of 108,832 acres would be achieved. *Mill and Deer Creeks Protection and Stewardship (ERP-02-P26)* has purchased 24.763 acres in conservation easements. These easements consist of various habitat types including grasslands that are used for grazing. Although grazing is considered agricultural and the lands do support various native plants and wildlife, these easements do not fit the description stated in the Ecosystem Restoration Program Plan Vol. II (CALFED Bay-Delta Program, 2000a).
- In the Feather River & Upper Basin EMZ, no ERP projects proposed managing land as wildlife-friendly agriculture. The ERP target is 57,578 acres.
- In the American Basin EMZ, no ERP projects produced wildlife-friendly agricultural lands. A new project, *American Basin Working Landscapes Project (ERP-05-S28)*, proposes to manage 400 acres as wildlife-friendly agriculture. If this goal is reached, approximately 2% of the target of 20,948 acres would be achieved.
- In the San Joaquin River EMZ, *Recovery Implementation for Riparian Brush Rabbit and Riparian Woodrat on the Lower Stanislaus River (ERP-02D-C11)* provides 40 acres that are currently being managed as a result of ERP. The ERP target is 15,290 acres.
- No ERP projects addressed the target proposing the restoration and maintenance of migration corridors for native plants of more than one mile in width in the West San Joaquin EMZ.

Currently ERP has not monitored or collected sufficient data to assess the assumptions made in regards to wildlife-friendly practices. However, several new projects will provide further knowledge about wildlife-friendly agricultural practices and their effect on harvested wildlife species and at-risk species:

- *Rice-Cover Crop Rotation Pilot Program (ERP-05-S27)*
- *American Basin Working Landscapes Project (ERP-05-S28)*
- *Sandhill Crane Use of Agricultural Lands in the Sacramento-San Joaquin Delta Region (ERP-05-S31)*
- *Evaluation of Giant Garter Snake Response to CALFED's Environmental Water Account Program: Adaptive Management for Wildlife-Friendly Farming (ERP-05-S32)*
- *Yolo-Solano Conservation Partnership for Habitat on Working Lands (ERP-05-S33)*
- *Staten Island Wildlife-Friendly Farming Demonstration (ERP-02-P08)*

In the Yolo Basin, the *Yolo Bypass Management Strategy, Phase II (ERP-01-N12)* is a project in which the Yolo Basin Foundation, together with Audubon-California, has been working with agricultural land owners to improve water quality and enhance wildlife-friendly values in the Union School and Willow Slough Watersheds.

Project Summary Table

Table 1. Agricultural Lands Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-00-F08	McCormack-Williamson Tract Restoration Planning, Design and Monitoring Program I Performed baseline studies necessary for project planning and design, and the development of long-term monitoring programs of the McCormack-Williamson Tract (M-W), which is a 1,600-acre Delta island.	8/1/2003	\$556,200	Research and planning for 1,512 acres of agricultural land.
ERP-01-N10	Cosumnes/Mokelumne Corridor Floodplain Acquisitions, Management, and Restoration Planning Phase 1 identified and acquired, from willing sellers, suitable parcels and conduct start-up stewardship activities, including baseline monitoring and preliminary restoration planning.	9/30/2007	\$3,044,342	Acquired 921.84 acres of conservation easement of various habitat types including wildlife-friendly agriculture, seasonal wetlands, uplands, and vineyards.
ERP-01-N12	Yolo Bypass Management Strategy, Phase II Continued technical research, planning, and stakeholder development efforts for implementation of potential habitat enhancement projects of the Yolo Bypass.	12/31/2006	\$284,142	Benefited approximately 59,000 acres of agricultural land.
ERP-01-N23	Staten Island Acquisition Acquisition and restoration of Staten Island (9,269 acres) to protect critical agricultural wetlands used by waterfowl and Sandhill cranes. Phase II of this project is <i>Staten Island Wildlife-Friendly Farming Demonstration (ERP-02-P08)</i> .	1/31/2006	\$35,110,873	Habitats include wildlife-friendly agriculture, marsh, riparian, and riverine.

Table 1. Agricultural Lands Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-01-N25	<p>Sustaining Agriculture and Wildlife Beyond the Riparian Corridor</p> <p>This project represents a collaborative effort to assess watershed conditions and test the efficacy of agricultural conservation practices primarily for water quality and wildlife benefits in the Bay-Delta region.</p>	6/30/2005	\$1,464,167	Project installed riparian hedgerows that benefited birds and other wildlife species, and installed sediment traps that effectively reduced sediment loads and increased water quality from runoff on agricultural lands.
ERP-01-N31	<p>Willow Slough Watershed Rangeland Stewardship Program</p> <p>Built on restoration efforts in the Willow Slough watershed to enhance and restore riparian and grassland habitats, improve forage quality, improve water quality, and reduce erosion. www.plantbiology.msu.edu/malmstrom/Audubon/index.htm</p>	12/31/2005	\$1,800,668	Addressed vision for Yolo Basin EMZ, promoted wildlife friendly agricultural practices.
ERP-02D-P54	<p>Restoring Ecosystem Integrity in the Northwest Delta: Phase II</p> <p>This project proposes to acquire conservation easements within the Cache Slough complex, along the Barker, Lindsey and Calhoun Sloughs, north Delta tidal channels located west of the Yolo Bypass.</p>	8/31/2008	\$1,563,506	Acquisition of conservation easements on 1,100 acres of existing riparian, wetland and/or agricultural lands. Currently in the process of acquiring an agricultural easement on 292 acres.
ERP-02-P08	<p>Staten Island Wildlife-Friendly Farming Demonstration</p> <p>Improved wildlife-friendly agriculture to foster recovery of at-risk species and to investigate effects of agriculture on water quality. Demonstration project for wildlife-friendly agriculture practices. Will increase habitat availability by allowing 2,500-5,000 acres of corn to be flooded for a longer duration than is presently possible. Also, determine the effect of winter flooding strategies on target bird species, namely greater sandhill crane and northern pintail (Delta EMZ).</p>	6/30/2007	\$1,757,459	Also see <i>Staten Island Acquisition (ERP-01-N23)</i> .
ERP-02-P26	<p>Mill and Deer Creeks Protection and Stewardship</p> <p>This project proposes to help address water quality and quantity, salmon habitat, and existing wildlife-friendly agriculture on Mill Creek and Deer Creek through conservation easements and active land stewardship.</p>	12/31/2008	\$4,700,000	Project will acquire conservation easements on over 26,000 acres of land on Mill Creek, and over 10,000 acres on Deer Creek.
ERP-02D-C11	<p>Recovery Implementation for Riparian Brush Rabbit and Riparian Woodrat on the Lower Stanislaus River</p> <p>Was ERP-02-P25-D and then was 02D-P59. This project will restore riparian habitats along the lower Stanislaus and San Joaquin rivers adjacent to the Caswell State Park and the SJ river National Wildlife Refuge.</p>	11/30/2008	\$6,427,131	50 out of 90 acres restored to riparian. Remaining 40 acres wildlife-friendly agriculture

Table 1. Agricultural Lands Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-05D-S22	Llano Seco Ranch Acquisition of a Conservation Easement on 4,235 +/- acres of real property located in Butte County, CA.	6/30/2006	\$2,570,000	See Sacramento River EMZ chapter.
ERP-05-S27	Rice-Cover Crop Rotation Pilot Program This project seeks to implement a three-year pilot project to benefit ground nesting birds, giant garter snakes, and other wetland dependent species through altered crop rotations and semi-permanent wetlands.	2/1/2011	\$1,649,051	~1,000 acres of wildlife friendly agriculture (Butte Basin EMZ).
ERP-05-S28	American Basin Working Landscapes Project Develop a GIS-based "working landscapes" model/plan for the American basin. Also, implement voluntary practices where appropriate, including easements, riparian restoration, wetland restoration, other on-farm, and farm-edge habitat restoration practices.	6/30/2010	\$1,860,898	~400 acres of wildlife-friendly agriculture. Restore 28 acres of riparian vegetation and riverine corridors and 28 acres of natural wetland systems.
ERP-05-S31	Sandhill Crane Use of Agricultural Lands in the Sacramento-San Joaquin Delta Region This project proposes to evaluate past Program investments in relation to their objectives to meet the needs of MSCS species such as the greater sandhill crane in order to develop recommendations to assist private farmers in contributing towards their recovery.	6/30/2010.	\$493,033	Research.
ERP-05-S32	Evaluation of Giant Garter Snake Response to CALFED's Environmental Water Account Program: Adaptive Management for Wildlife Friendly Farming Evaluation of the effects of rice field fallowing on giant garter snakes in order to meet the needs for regulatory guidelines for the EWA program.	6/30/2010	\$1,187,367	Research.
ERP-05-S33	Yolo-Solano Conservation Partnership for Habitat on Working Lands Proposed project would continue to develop collaborations to address restoration permitting needs, increase technical and economic incentives for farmers to increase habitat, conduct economic assessments. Project would include riparian habitat enhancement.	9/1/2010	\$2,257,973	Riparian habitat enhancements, irrigation canal re-vegetation, farm pond habitats, and wildlife and vegetation monitoring along with studies on ecosystem services, outreach, and education.
ERP-96-M13	Yolo Bypass Fish Habitat The objectives for this study are to examine the relationship between the Yolo Bypass and the rest of the Estuary and to develop recommendations for restoration actions that would improve Bypass habitat for fisheries and other aquatic organisms.	11/3/2000	\$226,000	Research and planning for <59,000 acres of agricultural land.
ERP-98-E13	Union School Slough Watershed Improvement Program This project developed California's first "service" to assist landowners with conservation practices and formed a landowner stewardship group for information sharing, problem-solving, and "neighbor-convincing."	5/14/2002	\$636,000	Benefited multiple habitat types.

Table 1. Agricultural Lands Project Summary

ERP Project Number	Project Name and Description	End Date	Total Funding	Project Status
ERP-99-F04	Part A: The McCormack-Williamson Tract Acquisition Acquired the McCormack-Williamson Tract.	12/31/2004	\$5,356,000	1,512 acres acquired, multiple habitats (Delta EMZ).

Other Programs Contributing to ERP Vision

Governmental and private agencies, as well as agricultural stakeholders involved in current agricultural land enhancement and management include:

- California Department of Fish and Game
- Delta Protection Commission
- California Department of Water Resources
- California Department of Transportation
- U.S. Fish and Wildlife Service
- U.S. Bureau of Land Management
- U.S. Bureau of Reclamation
- U.S. Natural Resources Conservation Service
- Ducks Unlimited
- Valley Care (Ducks Unlimited)
- Central Valley Habitat Joint Venture
- The Nature Conservancy
- resource conservation districts
- farm bureaus
- county agricultural commissions
- various county land planning agencies

Previous CALFED reports (CALFED Bay-Delta Program 2004a, 2004b, 2005, 2006) have stated significant progress toward, and in some cases the achievement of, the ERP Goals for agricultural lands. These statements are based primarily on the Central Valley Joint Venture, which is made up of more than 20 State, Federal, and private conservation organizations. The amount of wildlife-friendly agriculture reported by CVJV is shown in Table 2. Note that CVJV Basins do not equate to ERP Regions or Zones.

Agricultural enhancement objectives are currently exceeded for all basins, as most rice producers now use winter flooding to decompose straw (Central Valley Joint Venture 2006). However, agricultural easements to maintain waterfowl food supplies and buffer existing wetlands from urban development may become increasingly important in basins where large increases in human populations are predicted (Central Valley Joint Venture 2006). Currently, CVJV is not reporting land under agricultural easement, but it

is safe to assume that the vast majority is not, and therefore cannot, yet be fully counted toward reaching the agricultural lands goal.

Table 2. Agricultural enhancement objectives and accomplishments for wintering waterfowl by basin (Central Valley Joint Venture 2006)

Basin	1999 Winter Flooding Goal ^a	Current Winter Flooding	1990 Deferred Tillage Goal	Current Deferred Tillage ^c	1990 Basin Total Goal ^b	Current Basin Total ^c
American	11,140	72,049	3,713	-	14,853	72,049
Butte	72,151	99,494	24,050	-	84,361	99,494
Colusa	62,268	141,895	21,093	-	96,201	141,895
Delta	39,078	30,495	13,026	-	52,104	30,495
San Joaquin	-	-	-	-	-	-
Suisun	-	-	-	-	-	-
Sutter	33,845	33,168	11,282	-	45,127	33,168
Tulare	14,854	Unknown	4,951	-	19,805	Unknown
Yolo	14,879	7,020	4,960	-	19,839	7,020
Total	248,215	384,121	83,075	-	332,290	384,121

^aWinter flooding refers exclusively to winter flooding of rice habitat with the exception of the Delta Basin where 29,488 acres of winter flooded corn and 1007 acres of winter flooded rice are estimated. Winter flooded acres in Tulare Basin are unknown but not believed to be large.

^bSum of Winter Flooding and Deferred Tillage goals in the 1990 Plan.

^cEstimated sum of current Winter Flooding and Deferred Tillage acres as of 2003. Current Deferred Tillage is zero in all basins.

The Delta Protection Commission, through discussions with stakeholders and key policy makers in the Delta Region, developed a list of goals and criteria to prioritize the acquisition of Agricultural Conservation Easements (ACEs) in the Delta based upon the following public benefits: urban morphology, floodplain management, habitat conservation, and agricultural resources (Westhoff 2007). Using these criteria, GIS analysis was conducted to identify which parcels of land have the greatest number of public benefits and thus should be given the highest priority for ACEs (Westhoff 2007). The primary goal of the project was to develop a comprehensive system of identifying areas for agricultural conservation in the Delta that maximizes public benefits in order to gain the support of the region's stakeholders and existing land trusts so that ACEs can be implemented (Westhoff 2007). However, it is important to note the likely shift in priorities for acquiring easements on deeply subsided lands. It has been stated that investments on subsided lands may not be wise due to sustainability issues in the wake of threats such as seismic activities and sea level rise (Lund 2007).

Status of Topic Today

Except for the Delta, where agricultural lands were prioritized for ACEs (Westhoff 2007), ERP has not directly addressed the Stage 1 expectations of identifying high

priority agricultural lands, acquiring easements, developing and implementing incentive programs to encourage the planting of crops favored by wildlife, and practices that minimize environmental damage to adjacent areas. However, it is apparent that there has been a considerable amount of progress toward meeting the goals for agricultural lands. ERP needs to identify priority wildlife-friendly agricultural lands and acquire conservation easements to protect them from future alteration. Furthermore, ERP needs to conduct additional monitoring to identify the benefit of these agricultural practices to target species, especially species designated with a goal for recovery.

Waterfowl, like many other avian species, are highly mobile and can quickly respond to changes in distribution of preferred habitats (Fleskes et al. 2002). Distribution of waterfowl use among basins has not remained the same as during the 1970s, since habitat has increased, mostly in the Sacramento Valley region, and dabbling duck and goose use has shifted to the Sacramento Valley (Fleskes et al. 2005). During the past decade, changing agricultural practices and conservation programs have altered the landscape in the Central Valley. These habitat changes included wetland restoration and enhancement of agricultural habitats related to the implementation of the Central Valley Joint Venture Plan beginning in 1990; increased land area used in rice production due to improved prices and subsidies (Childs 1997); and more frequent flooding of rice fields after harvest to speed straw decomposition since air-quality legislation enacted in 1991 restricted rice burning. As a result, wintering habitat for waterfowl has increased in the Central Valley (Ackerman et al. 2006). This increase has been most apparent in the northern Central Valley where availability of rice lands increased by 94,000 acres (23% increase), flooded rice fields by 62,000 acres (47%), and wetlands by 72,000 acres (67%) between 1989 and 1999 (Ackerman et al. 2006). Despite recovery of most populations of waterfowl that winter in the Central Valley, waterfowl use-days remain well below the goal because of continued low abundance of northern pintails, the most common wintering species in the Central Valley (Fleskes et al. 2005).

In the Sacramento-San Joaquin Delta region, the loss of crane-compatible habitats continues due to land conversion into vineyards, turf farming, and urban areas (Ivey and Herziger, 2003). Additionally, some areas of the Delta where compatible crops remain are managed in ways not conducive to crane use; for example, foraging at Brack Tract has greatly decreased in recent years due to the plowing of corn and deep flooding of rice fields, which has limited available foraging habitat (Ivey and Herziger, 2003).

Planned Projects for Implementation

The *Yolo Bypass Management Strategy Project* (**ERP-01-N12**) is located in the 59,000 acre Yolo Bypass. The purpose of the project is to foster stakeholder stewardship in order to encourage practices that protect and enhance fish and wildlife habitat while respecting and maintaining economic viability of the land and water users, and to

maintain flood management functions. An unspecified amount will be managed as wildlife-friendly agricultural. The program established the Yolo Bypass Working Group, which developed the August 2001 report entitled "A Framework for the Future: Yolo Bypass Management Strategy." The report identified strategies developed by all the stakeholders within the bypass that were acceptable approaches for restoration. The report did not, however, state what to do and where to do it.

Restoring Ecosystem Integrity in the Northwest Delta: Phase II (ERP-02D-P54) is developing plans for fee acquisition or conservation easement acquisition within the Jepson Prairie-Prospect Island Corridor that protects continued agriculture and encourages wildlife-friendly practices.

The projects *Gauging the Benefits of Riparian Restoration/Enhancement in a Working Agricultural Landscape (ERP-05D-S36)*, *Yolo Wildlife Area: An Evolving Model for Integration of Agriculture and Habitat Restoration in a Flood Control Setting (ERP-05D-S37)*, and *Delta Working Landscapes (ERP-05-S34)*, which are currently funded but not yet executed, propose to restore and enhance native riparian habitat in working agricultural landscapes in the lower Mokelumne River Watershed, implement a pilot project on the Yolo Wildlife Area to assess three different rice field treatments for value and use of aquatic birds and impact on rice production, and work with local farmers to implement demonstration projects that improve habitat values while improving water quality, sediment transport, and levee stabilization, respectively.

Impediments to Implementation

The Yolo Bypass Management Strategy has not reached consensus among the various stakeholders.

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