

ERP DIRECTED ACTION
Development of a Central Valley Steelhead
Comprehensive Monitoring Plan

Reference
Ecosystem Restoration Program
Prop 50 Bond Funded
Project No. DFG ERP-05D-S05

Prepared by:
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Pacific States Marine Fisheries Commission

ERP DIRECTED ACTION

Development of a Central Valley Steelhead Comprehensive Monitoring Plan

Project Lead

Name: Pacific States Marine Fisheries Commission

Regional Coordinator:

Name: Katie Perry, California Department of Fish and Game

Cost of Project: \$367,888

Cost Share Partners: Cost-sharing will occur in the form of in-kind services of permanent staff time, equipment, and facilities and through the dedication of miscellaneous resources available from the agencies involved in the Steelhead PWT. Specifically, it is estimated that the project collaborators at California Department of Fish and Game, NOAA Fisheries, U.S. Fish and Wildlife Service, and U.S. Bureau of Reclamation will provide approximately 15% time for 12 months, or 2,200 hours of permanent biologist staff time to meet with the Project Team, provide study guidance, and assist the Project Team in preparation of the plan. Staff time for project collaborators is estimated at approximately \$70,400. Other biologists from Department of Fish and Game and Department of Water Resources, involved in Central Valley steelhead monitoring surveys, will also attend meetings with the Project Team, review the draft plan, and provide general project guidance. Staff time for these agency biologists is estimated at \$20,045.

List of Subcontractors: Pacific States Marine Fisheries Commission will subcontract for the services of a biostatistician. The biostatistician will be selected for the project by a panel consisting of the project lead, regional coordinator, and study collaborators.

Other Technical Experts:

Randy Benthin
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California Department of Fish and Game
Rancho Cordova, CA

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Red Bluff, CA

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U.S. Fish and Wildlife Service
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Proposal

1. Executive Summary

Project description: Central Valley steelhead were listed as threatened under the Endangered Species Act in 1998. Both the California Bay-Delta Authority (CBDA) and the Central Valley Project Improvement Act (CVPIA) have initiated recovery actions for this species, yet relatively little is known about its distribution, abundance and population trends. A comprehensive monitoring program that provides this information would be suitable for several purposes: providing a sound basis for implementing protective measures and assessing recovery of listed stocks; assisting in evaluating the success of restoration programs, such as those implemented through the CVPIA, Anadromous Fish Restoration Program (AFRP) and CALFED Bay-Delta Program, Ecosystem Restoration Program (ERP); fulfilling regulatory needs to assess and quantify population impacts from authorized activities, such as water diversions, fisheries, and hatcheries; evaluating the contribution of hatchery fish to Central Valley populations; and, providing life-history information helpful to improve management of the species.

Geographic location: This project is multi-regional and encompasses the entire Central Valley including the Sacramento Region, San Joaquin Region and Delta Region.

Project type: Planning / Monitoring

Project Objective: The objective of this proposal is to develop a comprehensive monitoring plan for Central Valley steelhead that, when implemented, will provide the data necessary to assess whether or not restoration and recovery goals are being achieved.

Approach to implement the proposal: The approach we will take to develop the monitoring plan will be to first assemble a Project Team that will include a project coordinator, biostatistician, database specialist, and biologist/planner. The Project Team will work with the Interagency Ecological Program's Steelhead Project Work Team and others to develop the comprehensive Central Valley steelhead monitoring plan. The Project Team will begin by reviewing the existing ad-hoc monitoring programs and explicitly define the objectives of the comprehensive monitoring plan. They will identify the appropriate spatial scales to assess status of populations and identify the methods to be used and an adaptive management process for refining the methods. The Project Team will identify temporal scale needed to assess population trends. They will propose a database structure and reporting techniques. At the completion of a draft monitoring plan there will be a public workshop. This workshop will provide feedback from experts at various agencies, stakeholders, and interested parties for consideration and incorporation into a final monitoring plan. Lastly, the Project Team will develop cost estimates for implementation of the monitoring plan.

Hypothesis and related uncertainties: What are the distribution, abundance and population trends of Central Valley steelhead? Our ability to develop and implement a comprehensive monitoring program of Central Valley steelhead may be hampered by several constraints and uncertainties. The primary constraints to steelhead monitoring include both natural and institutional factors. Natural constraints to steelhead monitoring are primarily attributable to the complex life-history of the species. A typical institutional constraint is that salmonid monitoring programs are often narrowly focused due to funding considerations or are focused

primarily on Chinook salmon due to their commercial importance. It is often assumed that steelhead and Chinook salmon suffer from the same level of impacts and that both species benefit from actions taken to recover Chinook salmon. However, steelhead life history strategies are considerably more variable and complex than salmon, and monitoring programs designed primarily for coho and Chinook salmon often fail to provide adequate information to assess steelhead abundance and population trends. These constraints will be considered when developing the monitoring plan. Scientific uncertainties regarding our ability to produce accurate and precise estimates of steelhead abundance will be dealt with through an adaptive management strategy. Uncertainties will be evaluated during an initial testing phase, and information gathered will be used to modify the monitoring plan as necessary. Additionally, adaptive management will be incorporated as part of the ongoing steelhead monitoring activities. As information is obtained through adaptive management, and we learn which specific sampling methods or strategies are successful and which are not, we anticipate the steelhead monitoring program will be modified to better achieve the goals of the comprehensive monitoring project.

Expected outcome: This project will provide the framework from which to implement and refine a long-term comprehensive monitoring plan for Central Valley steelhead.

Relationship to CALFED Bay-Delta Program Ecosystem Restoration Plan (ERP) goals or CVPIA goals: This proposal addresses Strategic Goal 1 of the ERP which is to achieve recovery of at-risk native species and reverse downward population trends. The proposal also addresses Strategic Goal 3 of the ERP that addresses harvestable species. The goal is to maintain and/or enhance populations of selected species for sustainable commercial and recreational harvest. Steelhead are an important sport fish and their recovery is dependent on our ability to estimate abundance and population trends. The monitoring plan developed will be valuable to the CBDA and the CVPIA, AFRP. When implemented, it will provide the data necessary to assess whether or not restoration and recovery goals are being achieved.

2. Project Background and Information

Central Valley steelhead were listed as threatened under the Endangered Species Act (ESA) in March 1998. As a result of the decline of steelhead and Chinook salmon, considerable efforts have been initiated to bring about recovery of anadromous fishes and their habitat. In 1988 the state of California passed legislation creating a policy to significantly increase the natural production of salmon and steelhead trout by the end of the century (California Salmon, Steelhead Trout, and Anadromous Fisheries Program Act, Fish and Game Code Sections 6900 - 6924). The two most recent and notable restoration efforts are mandated by the Central Valley Project Improvement Act (CVPIA) of 1992, Anadromous Fish Restoration Program (AFRP), and the California Bay-Delta Program (ROD August 2000), now authorized by the California Bay-Delta Authority Act of 2003. In addition, the NOAA Fisheries has recently begun the recovery planning process for listed salmonids in the Central Valley.

While these restoration and recovery efforts have been initiated, our ability to measure their success at improving the status of Central Valley steelhead has been hampered by almost a complete lack of information regarding their distribution, abundance and population trends. The objective of this proposal is to develop a comprehensive monitoring plan for Central

Valley steelhead that, when implemented, will provide the data necessary to assess whether or not restoration and recovery goals are being achieved.

The Interagency Ecological Program (IEP) Steelhead Project Work Team (Steelhead PWT) reconvened in March 2002 to provide a forum whereby biologists and resource managers could share information about Central Valley steelhead, identify knowledge gaps, and investigate the feasibility of developing a coordinated and comprehensive monitoring program for Central Valley steelhead. The IEP Steelhead PWT is composed of representatives from California Department of Fish and Game (CDFG), NOAA Fisheries, U.S. Fish and Wildlife Service (USFWS), U.S. Bureau of Reclamation (USBR), California Department of Water Resources (CDWR), and U.S. Forest Service (USFS).

In 1999, the previous IEP Steelhead PWT prepared a report for the California Bay-Delta Program's Comprehensive Monitoring Assessment and Research Program (CMARP) that described the monitoring, assessment and research needs for Central Valley steelhead (IEP Steelhead PWT 1999). The report included an outline of a monitoring approach that could be taken to fill in knowledge gaps, collect baseline information on species abundance and habitat, and gauge the effects of habitat restoration actions. The current IEP Steelhead PWT has determined that virtually none of the monitoring recommended in 1999 has been implemented and that currently there is no coordinated, comprehensive, and consistent monitoring program for steelhead in the Central Valley.

Benefits of developing and implementing a comprehensive monitoring program for Central Valley steelhead

A comprehensive monitoring program, that provides estimates of abundance and population trends of Central Valley steelhead, would be suitable for the following purposes:

- Provide a sound basis for implementing protective measures and assessing recovery of listed stocks;
- Assist in evaluating the success of restoration programs, such as those implemented through the CVPIA, AFRP and California Bay-Delta Authority Ecosystem Restoration Program (ERP);
- Fulfill regulatory needs to assess and quantify population impacts from authorized activities, such as water diversions, fisheries, and hatcheries;
- Evaluate the contribution of hatchery fish to Central Valley populations;
- Provide life history information helpful to improve management of the species.

Under the ESA recovery is defined as an improvement in the status of a listed species to the point at which listing is no longer appropriate. Recovery and subsequent delisting occurs when a species is no longer threatened or endangered in all or a significant portion of its range. NOAA Fisheries has begun the recovery planning process for winter-run and spring-run Chinook salmon and steelhead in the Central Valley. A Technical Recovery Team (TRT) has been selected that will develop objective and measurable goals for delisting. To assess the status of Central Valley steelhead in regards to delisting criteria, the TRT will need a way to assess when and if a species has met these goals. A comprehensive monitoring plan for Central Valley steelhead will outline a monitoring strategy that would allow managers to obtain the data necessary to determine the present status of the species and, when carried out over time, it will provide trend data, such as growth rate/productivity, spatial structure, and diversity, which are essential to assess recovery status.

When species are listed under the ESA any activity that may adversely affect the species must be authorized by NOAA Fisheries. Various sections of the ESA govern the take of listed species. Through section 4 (d) of the ESA, NOAA Fisheries has issued a rule that governs take of the threatened Central Valley steelhead. The 4(d) rule states that take prohibitions will not apply to fishery management activities within the ESU if the fisheries are managed in accordance with an approved Fishery Management and Evaluation Plan (FMEP). Likewise, take prohibitions will not apply to artificial propagation programs provided that a Hatchery and Genetics Management Plan (HGMP) has been approved by NOAA Fisheries. Both of these plans require knowledge of the status of the affected population and adequate monitoring to be able to detect and evaluate impacts of the proposed activities. We presently lack such information. The development and implementation of a comprehensive monitoring program for Central Valley steelhead will provide information that will assist in evaluating impacts of these activities.

Under section 7 of the ESA NOAA Fisheries consults with federal agencies to ensure that any action authorized, funded or carried out by such agency is not likely to jeopardize the continued existence of threatened or endangered species. In September 2002, NOAA Fisheries issued a biological opinion on interim operations of the Central Valley Project and State Water Project on listed salmonids in accordance with section 7 of the ESA. The biological opinion contains reasonable and prudent measures to minimize take of listed salmonids and terms and conditions to implement these measures. Included in the terms and conditions is a requirement for the USBR and DWR to participate in the design and implementation of a monitoring program for listed salmonids in CVP and SWP controlled streams including the following activities: adult and juvenile direct counts, redd surveys, and escapement estimates. In addition, the biological opinion includes a conservation recommendation that the USBR and DWR support and expand salmonid monitoring programs throughout the Central Valley. Expanded monitoring programs will improve our understanding of salmonid life history strategies and improve our ability to provide protection through real-time management of the CVP and SWP facilities. USBR and DWR staff will assist in the development of a comprehensive monitoring program for Central Valley steelhead and these agencies will assist in carrying out portions of the monitoring activities.

As mentioned above, there are several restoration programs underway in the Central Valley targeting salmonids and their habitat. The CVPIA directs the Secretary of the Interior to develop and implement programs and actions to ensure that by 2002, the natural production of anadromous fish in Central Valley streams will be sustainable, on a long-term basis, at levels at least twice the average levels of natural production in the 1967 through 1991 baseline period. Additionally, the California Bay-Delta Authority ERP, was established to help restore and improve the health of the Bay-Delta system for all native species. To gauge whether and which habitat restoration activities are benefiting salmonid populations, it is necessary to determine population level responses to restoration actions and to evaluate population trends over time. The development and implementation of a comprehensive monitoring program for Central Valley steelhead will provide information that will assist in evaluating benefits of these activities.

Adequacy of Existing Monitoring Programs

Reviews of existing salmonid monitoring programs within the Central Valley have concluded that they are not adequate for determining steelhead population status and trends (IEP

Steelhead PWT 1999, Busby et al. 1996, NOAA Fisheries 2003). In 1999, the IEP Steelhead PWT found that the primary constraints to steelhead monitoring included both natural and institutional factors. Natural constraints to steelhead monitoring are primarily attributable to the complex life history of the species. A typical institutional constraint is that salmonid monitoring programs are often narrowly focused due to funding considerations or are focused primarily on Chinook salmon due to their commercial importance. It is often assumed that steelhead and Chinook salmon suffer from the same level of impacts and that both species benefit from actions taken to recover Chinook salmon (IEP Steelhead PWT 1999). However, steelhead life history strategies are considerably more variable and complex than salmon, and monitoring programs designed primarily for coho and Chinook salmon often fail to provide adequate information to assess steelhead abundance and population trends (Jacobs et al. 2001, IEP Steelhead PWT 1999). The methods typically used to monitor Chinook and coho salmon are not entirely applicable to steelhead for the following reasons: 1) Adult steelhead migrate during high flow periods when monitoring equipment cannot be easily deployed; 2) Carcass surveys, which are often used for Chinook salmon escapement estimates, cannot be used for steelhead because many survive spawning and can spawn again in subsequent years; 3) Steelhead redds are difficult to distinguish from resident rainbow trout and Chinook salmon redds and they are difficult to observe due to high flows and turbid waters; 4) Spawning seasons are generally protracted (i.e., October through June, peaks from December through April (McEwan 2001)); 5) Steelhead are very elusive and hard to count in underwater surveys; and, 6) Juvenile steelhead rear in freshwater for one to three years, emigrate at a larger size than Chinook salmon, and are not as vulnerable to trapping methods.

Among the knowledge gaps identified by the IEP Steelhead PWT in 1999, the most significant is the lack of comprehensive presence/absence information and run size estimates. Steelhead monitoring data are limited to tributaries or rivers where known steelhead populations exist, including: Battle, Mill, Deer and Butte creeks, and the Feather, Yuba and American rivers. Recent presence and absence surveys in Upper Sacramento River tributaries have shown that steelhead exist but were previously undetected due to lack of monitoring (Moore 2001, unpublished report). Steelhead have also been found in San Joaquin River tributaries in recent years (CDFG unpublished data). Comprehensive monitoring is needed to determine their valley-wide distribution.

During the 1996 status review of west coast steelhead, the NOAA Fisheries Biological Review Team (BRT) found only one stock within the Central Valley steelhead ESU that was adequately monitored to assess adult escapement trends: the Sacramento River population above Red Bluff Diversion Dam (RBDD) (Busby et al. 1996). Run size estimates at RBDD were made between 1967 and 1993. However, since 1995 the gates at RBDD have been raised from September 15 through May 15 to facilitate migration of endangered Sacramento River winter run Chinook salmon, thus eliminating the ability to make steelhead run size estimates. The BRT concluded that the absence of recent run size estimates was a major area of uncertainty with regard to the status of the ESU. In fact, a recent draft updated status review concluded that the Central Valley steelhead ESU was in danger of extinction. They reiterated the earlier BRT's concern about the lack of any steelhead specific monitoring (NOAA Fisheries 2003).

In 1999 the IEP Steelhead PWT found that there were 40 salmonid monitoring programs in the Central Valley. Twenty of these programs collected data on both salmon and steelhead, 12 were focused on salmon but provided incidental steelhead information, and only eight were specifically focused on steelhead (IEP Steelhead PWT 1999). Current monitoring

programs for juvenile and adult salmon and steelhead are shown in Tables 1 and 2, respectively. There are 13 monitoring programs that collect data on adult steelhead, but four of these are angler surveys which were discontinued in 2003 due to lack of funding. Redd surveys are conducted on Clear Creek, and the American and Mokelumne rivers. Snorkel surveys are conducted on Clear and Battle creeks. Hatchery counts are made on Battle Creek, and the Feather, American and Mokelumne rivers. An Alaskan-style weir on the Stanislaus River has been in place for one season and can collect adult steelhead data. The juvenile salmon and steelhead monitoring programs collect information on both species, but due to the sampling methods and difficulties associated with sampling juvenile steelhead they probably do not effectively sample steelhead. Only two juvenile salmonid monitoring programs are focused on steelhead; a snorkel survey in the Feather River and a PIT tagging study on the American River. It is evident from reviewing the existing monitoring programs that the collection of steelhead population data is still conducted on an ad-hoc basis and is inadequate to estimate species status and trends.

In Oregon adult steelhead abundance and trend information was traditionally obtained from a combination of dam passage counts and angler catch card records (Jacobs et al. 2001). As steelhead populations declined, Oregon Department of Fish and Wildlife (ODFW) restricted the harvest of natural origin steelhead. The elimination or significant reduction in angler retention of natural origin steelhead essentially eliminated the use of catch-card data for indexing trends in coastal populations. ODFW then began developing integrated strategies for monitoring coastal salmonid populations. Included in these strategies was the development of monitoring methodologies for steelhead stocks. They first reviewed historic data and published literature in order to determine the best methods for monitoring steelhead. Then beginning in 1998 ODFW began carrying out pilot steelhead spawning surveys and comparing survey counts above adult counting stations with known steelhead abundance. Over three years (1998-2001) they found a highly significant relationship between steelhead spawner abundance and number of redds counted upstream from four calibration sites. They found that redd counts may provide a reliable means of indexing the abundance of Oregon coastal steelhead (Jacobs et al. 2001). ODFW has been continuing their calibration studies at the Smith River, but because no monitoring for coastal steelhead was in place in 2001 they recommended that systematic redd counts be initiated immediately in Oregon coastal basins.

Since a considerable number of monitoring methodologies have been tested and used in the Central Valley by various agencies and individuals, we expect to be able to build on the available expertise to develop a comprehensive monitoring plan that takes into account past successes and failures. The monitoring plan should be flexible enough so that if additional testing of specific methods is needed at specific locations, then we can identify these research needs in an adaptive management plan and integrate the revised methods over time.

Coordination with the monitoring program for Chinook salmon

The Central Valley Salmon Escapement PWT has determined that existing adult Chinook salmon escapement monitoring programs in the Central Valley are currently inadequate to estimate population status and evaluate population trends in a statistically valid manner.

With the goal of fulfilling this critical need for improved monitoring of Chinook salmon in Central Valley streams, the Salmon Escapement PWT has prepared a proposal to develop a long-term monitoring plan to estimate abundance and trends of adult Central Valley Chinook salmon at the watershed level in a statistically valid manner. Their approach in developing this monitoring plan is to assemble a Project Team consisting of a project coordinator,

biostatistician, database specialist and biologist/planner who will work closely with the Central Valley Salmon Escapement PWT through all phases. They will start with a review of the existing monitoring programs and then develop a revised coordinated, basin-wide approach to monitoring. Their proposal includes developing cost estimates for the revised and new monitoring programs, as well as costs for data management and reporting. The Chinook salmon proposal is related to the steelhead proposal described here. There has been coordination between the Chinook Salmon Escapement PWT and the Steelhead PWT and the development of the monitoring plans will be coordinated to the greatest extent possible.

3. Project Goals and Objectives

The goal of this proposal is to develop a comprehensive monitoring plan for Central Valley steelhead that, when implemented, will provide the data necessary to assess whether or not restoration and recovery goals are being achieved.

Questions: What are the distribution, abundance and population trends of Central Valley steelhead?

To assess the distribution, abundance and population trends of Central Valley steelhead will require identification of the demographic scale (e.g., population, ESU), spatial scale (e.g., sub-basin, watershed) and temporal scale (e.g., annual, periodic), using sampling methods that are tailored for those applications. Because direct counts of all adults are not always possible, the monitoring plan will rely on estimates of both adult and juvenile abundance. Estimates will be based on a statistically rigorous sampling program so that accuracy and precision can be defined (e.g., +/- 10%, 20% 30%). The objectives listed below will guide the development of a monitoring plan that will provide information on the status and trends of the species.

Distribution Monitoring:

Objective 1. Identify the distribution of steelhead in the Central Valley to assess range expansion or contraction.

Sub-objective:1.1. Determine which sampling locations are appropriate to assess steelhead distribution.

Sub-objective 1.2. Determine which sampling methods (e.g, presence/absence) are appropriate to assess steelhead distribution.

Sub-objective 1.3. Determine the sampling period (e.g., 5-10 year) needed to assess steelhead distribution.

Adult Monitoring:

Objective 2. Use existing knowledge, expertise, and data to identify steelhead populations, for which monitoring of adults (i.e., natural and hatchery origin) is critical to assess current abundance and population trends of the Central Valley steelhead.

Objective 3. Identify monitoring locations, sampling methods, and sample periods necessary to assess adult steelhead abundance and population trends for Central Valley steelhead populations.

Sub-objective 3.1. Determine which sampling locations are most appropriate to use for monitoring adult abundance and population trends for Central Valley steelhead populations.

Sub-objective 3.2. Determine what sampling methods are most appropriate to use for monitoring adult abundance and population trends of Central Valley steelhead populations (e.g., snorkel surveys, trap catches, ladder/weir counts, mark-recapture, redd counts, trawls).

Sub-objective 3.3. Determine which sampling periods are most appropriate to use for monitoring adult abundance and population trends for Central Valley steelhead populations.

Objective 4. Provide the basis for determining population estimates, including expansion factors, other adjustments (e.g., harvest removals), and an assessment of accuracy and precision.

Juvenile Monitoring:

Objective 5. Use existing knowledge, expertise, and data to identify steelhead populations, for which monitoring of juveniles (e.g., outmigrating smolts) would provide an index of population status or provides an index of population productivity.

Objective 6. Identify monitoring locations, sampling methods, and sample periods necessary to assess juvenile steelhead abundance for Central Valley steelhead populations.

Sub-objective 6.1. Determine which sampling locations are most appropriate to use for monitoring juvenile abundance for Central Valley steelhead populations.

Sub-objective 6.2. Determine what sampling methods are most appropriate to use for monitoring juvenile abundance of Central Valley steelhead populations (e.g., smolt traps, electrofishing).

Sub-objective 6.3. Determine which sampling periods are most appropriate to use for monitoring juvenile abundance for Central Valley steelhead populations.

Objective 7. Provide the basis for determining juvenile abundance estimates, including expansion factors, other adjustments (e.g., daylight trapping only), and an assessment of accuracy and precision.

4. Approach/Methodology

We anticipate that the approach taken by the project team will be a phased approach. The project addressed in this proposal considers Phase 1 of what we expect to be a multi-phased

process of developing a monitoring program, to be followed by pilot testing, and then full implementation. Phase 1 of the plan will include:

- Explicitly defining the objectives of the monitoring plan
- Identify the appropriate spatial scales to assess status of populations
- Identify the methods to be used and an adaptive management process for refining the methods
- Identify temporal scale needed to assess population trends
- Propose a database structure and reporting techniques.

The IEP Steelhead PWT has decided to use a similar approach to the Central Valley Salmon Escapement PWT in developing a comprehensive monitoring program for Central Valley steelhead. We will begin by conducting a more thorough review of the existing monitoring programs and the adequacy of the steelhead data currently being collected. A Project Team will be assembled that will include a project coordinator, biostatistician, database specialist, and biologist/planner. The Project Team will work with the Steelhead PWT and others to develop the comprehensive Central Valley steelhead monitoring plan.

The geographic scope of this monitoring plan will encompass the Central Valley evolutionarily significant unit (ESU) of steelhead (Figure 2). Due to the large geographic scale of the proposed monitoring plan, we expect that the project team may divide the Central Valley into sub basins (e.g., Upper Sacramento River basin) and will work with Steelhead PWT representatives and others from those areas to identify the sampling locations and methods for juvenile and adult steelhead. The monitoring strategy developed will include an adaptive management plan to test and refine specific methods and specific sampling locations. A public workshop will be held to present the proposed monitoring plan and to obtain peer review feedback. We anticipate that the public workshop participants will include representatives of the federal Technical Recovery Team (TRT), the IEP Steelhead PWT, the IEP Central Valley Salmonid Project Work Team, stakeholders, and other interested parties.

Phase 1: Monitoring Plan Development

Task 1. Review existing programs. The Project Team and the IEP Steelhead PWT will review and critique the existing Central Valley steelhead monitoring programs and associated databases. The members of the IEP Steelhead PWT have the best information regarding the feasibility of monitoring at various locations throughout the Central Valley and knowledge of the key information gaps. This review will assist in developing a spatially balanced sampling design.

Task 2. Develop draft monitoring plan. The Project Team will meet with the IEP Steelhead PWT to review the information obtained from Task 1.

The sampling design will estimate status and trends in abundance, as well as distribution of steelhead. These estimates will be made with a known precision. We expect that a spatially balanced site selection process will be used. Sampling strategies will be determined for steelhead at specific monitoring locations. It will be necessary to determine the type of data to be collected (e.g., adults spawner counts, redd surveys, juveniles outmigrants). Numerous factors will play a role in the particular monitoring approach that is chosen for a particular stream or location. For instance, the ability to conduct monitoring at a particular location

may be hampered by land owner restrictions, access through difficult terrain, extreme stream flows and safety constraints, inability to distinguish redds, etc. Based on these potential limitations for sampling, some stream reaches may be better suited to juvenile outmigrant monitoring. New sampling methods may need to be developed and tested such as the Alaskan style weir being tested on the Stanislaus River.

An adaptive management strategy will be developed to identify, study, and resolve scientific uncertainties regarding assessments of steelhead abundance and population trends. The adaptive management strategy will include a description of project goals and objectives, and include conceptual models. The adaptive management plan will identify and prioritize uncertainties surrounding estimates of steelhead abundance. The adaptive management plan will also include a description of the decision making process. A draft comprehensive Central Valley steelhead monitoring plan, including an adaptive management strategy, will be prepared and distributed to all interested parties prior to the public workshop.

Task 3. Public workshop. The Project Team will present the draft monitoring plan and adaptive management plan at a public workshop. The monitoring program being developed through this proposal will be designed, when possible, to integrate with existing monitoring efforts throughout the Central Valley. The public workshop will bring together the various agencies, other stakeholders, and interested parties to review the monitoring and adaptive management plans. A possible result of this planning process may be recommendations to modify some existing monitoring programs in order to achieve the goals of this comprehensive effort, as well as providing guidelines for planning future new monitoring activities.

Task 4. Develop cost estimates. In coordination with the IEP Steelhead PWT, the Project Team will develop cost estimates for implementing the monitoring program as described in the draft monitoring plan, including data management and reporting. Potential funding sources and funding priorities will be identified.

Task 5. Project management and reporting. The Project Team and Project Manager will prepare quarterly fiscal and programmatic reports. The reports will summarize the activities and expenditures during the previous quarter. The project team will prepare and submit the draft monitoring plan to the IEP Steelhead PWT, the Central Valley Salmonid PWT, NOAA Fisheries Central Valley Technical Recovery Team, and interested parties for review prior to the public workshop. The Project Team will prepare and submit a final monitoring plan to these same groups.

Again, the project addressed in this proposal considers Phase 1 only. Phase 2 and 3 are not covered in this proposal, but are included for context of the longer term objectives.

Phase 2: Pilot Testing and Evaluation

A pilot testing program will be used to evaluate selected steelhead monitoring locations and techniques and to provide information to resolve key scientific uncertainties. Data collected during the pilot testing phase will be used to evaluate and, as necessary, modify the monitoring program to achieve project goals.

Phase 3: Long-Term Monitoring Plan Implementation and Refinement

The long-term monitoring plan will be implemented by various agencies and entities throughout the Central Valley and will require on-going evaluation, refinement, and coordination. It is anticipated that the IEP Steelhead PWT will continue to provide the forum for these efforts. Periodic review by outside experts should occur every five years.

A primary value of this project to decision-makers is that it will provide a blueprint from which to implement the comprehensive steelhead monitoring program. Without this blueprint it is likely that Central Valley steelhead monitoring efforts will continue to be project specific and not suitable for determining the population status and trends.

5. Subcontractors (include description of tasks and qualifications)

Pacific States Marine Fisheries Commission will subcontract for the services of a project biostatistician. The biostatistician will be selected for the project by a panel consisting of the project lead, regional coordinator, and study collaborators.

The biostatistician will be an integral part of the project team, involved in Tasks 2, and 3. In particular, the biostatistician will be responsible for statistical analysis in Tasks 2 and 3 as follows:

Task 2. Development of a draft monitoring plan. After a comprehensive review of existing Central Valley steelhead monitoring methods in Task 1, the biostatistician will participate with the Project Team in the development and documentation of a draft monitoring plan. The monitoring plan will be based on statistically-sound sampling, data analysis, data storage, and reporting protocols. The draft monitoring plan will be developed in close coordination with project collaborators, the Steelhead PWT and the Central Valley Salmonid PWT. Due to the known difficulties associated with sampling adult steelhead, we anticipate that the draft monitoring plan will contain a hierarchy of alternative methods with corresponding levels of precision and accuracy. The biostatistician will be responsible for identifying and documenting these differences.

Task 3. Public Workshop. The draft monitoring plan will be presented at a public workshop to feedback from various agencies, stakeholders and interested parties. The biostatistician will be responsible for presenting information on the statistical methods and levels of accuracy and precision associated with the monitoring activities and any alternatives.

6. Tasks and Deliverables (Description)

Quarterly fiscal and programmatic reports will be submitted by the 10th day of the month following the end of each quarter (January, April, July, and October). The draft monitoring plan will be submitted prior to the public workshop. At the completion of the project a final comprehensive Central Valley steelhead monitoring plan will be submitted. The final monitoring plan will include recommendations concerning the implementation of the pilot testing and evaluation phase as well as recommendations for data management.

7. Special Equipment and Supplies required

Computers, printers, telephones, and office supplies will be needed for Project Team.

8. Environmental Permitting Requirements

The project consists of the development of a plan; therefore, no environmental permits or agreements will be necessary to complete the tasks.

9. Species Impacted/Affected

Central Valley steelhead (*Oncorhynchus mykiss*)

10. Stakeholders and Interested Parties

State agencies involved in this project include California Department of Fish and Game, and California Department of Water Resources. Federal agencies include NOAA Fisheries, U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, and the U.S. Forest Service. Other stakeholders and interested parties include the Pacific States Marine Fisheries Commission, East Bay Municipal Water District, and various water districts throughout the Central Valley. Study collaborators include representatives from each of the State and Federal fish and wildlife agencies.

11. Exhibits

Table 1 – Project Timeline

Exhibit A – Budget Detail

Exhibit B – Task Deliverables

EXHIBIT A – Budget Summary
Development of a Central Valley Steelhead Comprehensive Monitoring Plan

Project Totals

Labor	Benefits	Travel	Supplies and Expendables	Services and Consultants	Equipment	Lands and Rights of Way	Other Direct Costs	Direct Total	Indirect Costs	Total
\$168,186	\$65,472	\$12,990	\$11,000	\$52,000	\$5,000	\$0	\$10,000	\$324,648	\$43,239	\$367,888

Year 1 (Months 1 to 12)

Task	Labor	Benefits	Travel	Supplies and Expendables	Services and Consultants	Equipment	Lands and Rights of Way	Other Direct Costs	Direct Total	Indirect Costs	Total
1: Review Existing Programs	\$32,712	\$11,962		\$2,000	\$10,000					\$8,501	\$65,175
2: Develop Draft Monitoring Plan	\$24,265	\$8,319			\$5,000					\$5,637	\$43,221
3: Public Workshop											
4: Develop Cost Estimates											
5: Project Mgmt & Admin	\$9,444	\$3,452	\$4,990	\$4,500	\$5,000	\$5,000		\$4,000			\$36,386
Totals	\$66,421	\$23,733	\$4,990	\$6,500	\$20,000	\$5,000		\$4,000	\$130,644	\$14,138	\$144,782

Year 2 (Months 13 to 24)

Task	Labor	Benefits	Travel	Supplies and	Services and	Equipment	Lands and	Other Direct	Direct Total	Indirect Costs	Total
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				Expendables	Consultants		Rights of Way	Costs			
1:Review Existing Programs											
2: Develop Draft Monitoring Plan	\$58,056	\$22,999			\$20,000					\$15,159	\$116,214
3: Public Workshop	\$18,600	\$5,925								\$3,679	\$28,204
4: Develop Cost Estimates	\$2,686	\$3,902		\$3,000						\$1,439	\$11,027
5: Project Mgmt & Admin	\$22,423	\$8,913	\$8,000	\$1,500	\$12,000			\$6,000		\$8,825	\$67,661
Totals	\$101,765	\$41,739	\$8,000	\$4,500	\$32,000			\$6,000	\$194,004	\$29,102	\$223,106

EXHIBIT B – TASK DELIVERABLES

Development of a Central Valley Steelhead Comprehensive Monitoring Plan

<u>Task</u>	<u>Task Title</u>	<u>Deliverable</u>	<u>Estimated Completion Dates</u>
1	Review Existing Programs	<ul style="list-style-type: none"> • Summary report on existing Central Valley steelhead monitoring programs 	<ul style="list-style-type: none"> • June 2006 (6 months after contract execution)
2	Develop Draft Monitoring Plan	<ul style="list-style-type: none"> • Quarterly Progress Reports 	<ul style="list-style-type: none"> • Throughout the contract term. Due 10th of Jan., April, July, Oct.
3	Public Workshop	<ul style="list-style-type: none"> • One Day Workshop 	<ul style="list-style-type: none"> • February 2007
4	Develop Cost Estimates	<ul style="list-style-type: none"> • Quarterly Progress Reports 	<ul style="list-style-type: none"> • Throughout the contract term. Due 10th of Jan., April, July, Oct.
5	Project Mgmt & Admin	<ul style="list-style-type: none"> • Quarterly Progress Reports • Monthly Invoices • Draft Monitoring Plan • Final Monitoring Plan • Project Close Out Report • Final Invoice 	<ul style="list-style-type: none"> Throughout the contract term. Due 10th of Jan., April, July, Oct. • 10th of each month following billing period • January 31, 2007 (12 months after contract execution) • June 30, 2007 (18 months after contract execution) • 30 days prior to end of contract term • August 2007

Note: Public Participation and Environmental Compliance and Permitting are not separate tasks in this proposal since they are not required as part of this project. Draft and Final Plans are included in Task 5, Project Management and Administration.