Lower Clear Creek Floodway Rehabilitation Project
Proposal
Phase 3B

Presented to
The California Bay-Delta Authority
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LOWER CLEAR CREEK FLOODWAY REHABILITATION PROJECT

A Proposal Submitted by: **Western Shasta Resource Conservation District**
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Local government/district

In collaboration with: **Lower Clear Creek Coordinated Resource Management and Planning Group and Lower Clear Creek Restoration Team**

Executive Summary:
This proposal requests funding to complete the next phase (Phase 3B) of the Lower Clear Creek Floodway Rehabilitation Project, and, in doing so, addresses a headcut that is threatening previous successful phases of the Project. This Project was initiated in 1998 to address impaired geomorphic, riparian, and salmonid habitat conditions on Clear Creek along the 1.8 mile reach degraded by historic gravel mining. Mining destroyed the natural channel and floodplain morphology, removed large volumes of sediment, exposed the underlying clay hardpan, and created ponds that strand adult and juvenile salmonids. The restoration approach developed by the multi-agency Clear Creek Restoration Team focuses on using local and imported alluvial materials to refill the floodway and restore bankfull channel dimensions, re-create floodplains, and revegetate floodplains with native riparian vegetation. The first two phases of the Project (Phases 1 and 2A) used a rather unique approach to salmonid habitat restoration by utilizing reclaimed dredge materials from upstream borrow locations to simultaneously rehabilitate riparian and wetland habitat. This lowered the cost significantly rather than using aggregate purchased from commercial suppliers. With the use of mercury during historic gold extraction practices on Clear Creek, concerns were raised in 2001 regarding use of potentially contaminated dredger tailings. Therefore, subsequent restoration phases (Phases 2B and 3A) were implemented with on-site borrow sources that were determined to have no history of gold dredging. Phase 3B will continue this approach, as local alluvial borrow sites have been located which will provide sufficient material and also allow creation of additional functional floodplain and 25 acres of riparian habitat through revegetation.

Previous phases of the project, implemented with CALFED Ecosystem Restoration Program and Central Valley Project Improvement Act (CVPIA) funding, imported or moved a total of 275,000 cubic yards of aggregate to fill ponds and restored 90.8 acres of floodplain. In one construction season, Phase 3B will reconstruct the bankfull channel for this next phase of the restoration project, contiguous with floodplain surfaces restored in previous phases. It will also stabilize a headcut that is migrating into previous project areas and is threatening to undo or damage the investments to date. The Project is supported by the Lower Clear Creek Coordinated Resource Management Group; CALFED through previous funding and objectives to recover Priority Group I Salmonid Species; the US Bureau of Reclamation and the U.S. Fish and Wildlife Service through previous funding and Section 3406 of the CVPIA; the U.S. Bureau of Land Management through cost sharing and property acquisition; the Anadromous Fish Restoration Program (AFRP); and multiple agencies involved with project design, engineering and restoration (Lower Clear Creek Restoration Team). The design of Phase 3B was funded by the US Bureau of Reclamation earlier this year which will enable construction to being in 2006 with CALFED funding. Completion of Phase 3B will not only significantly improve salmonid/aquatic habitat, riparian and wildlife habitat, and fluvial geomorphic processes in Clear Creek, it will also protect previous investments and provide CALFED with monitoring programs detailing the success of the project, numerous project-related experiments, and a model Demonstration Stream available for immediate and continued adaptive management opportunities.

A. Project description: Project Goals and Scope of Work

1. Problems, Goal and Objectives

a. Background:
Since 1996, a unique partnership between local, state, and federal agencies, and local stakeholders has resulted in a step by step reduction of the large-scale disruption that occurred in the Clear Creek drainage system as a result of gold mining, gravel mining, dams and water diversion. These historical alterations in natural stream flow resulted in impaired fluvial geomorphic processes, a damaged channel and devastated salmonid populations. Through this unique multi-agency partnership and the commitment of over 21 million dollars to date from multiple agencies and programs, the stream and its salmonid populations are being restored. The project has expanded suitable spawning habitat and created new, functional channel segments, introduced coarse sediments to the new channel segments, and restored large sections of the channel and floodways to their natural state.

b. Problem:
Clear Creek originates near 6,000 ft elevation in the Trinity Mountains, and flows south between the Trinity River basin to the west and the Sacramento River basin to the east. Upper Clear Creek flows into Whiskeytown Lake (Elevation 1,210 ft) at Oak Bottom, 11 miles west of Redding (Figure 1). The lower section of Clear Creek (lower Clear Creek) flows south from Whiskeytown Dam for approximately 8 miles, then east for 8 miles before joining the Sacramento River five miles south of Redding. Until 2000, Saeltzer Dam blocked most of the spawning habitat between the Sacramento River and Whiskeytown Dam.

Major Pierson B. Reading discovered gold at the present-day Clear Creek Road Bridge in 1848. Following this historic discovery, the lower Clear Creek watershed was extensively altered, beginning with placer mining and dredger mining for gold up through the 1940's. Floodplains and terraces along the corridor were "turned upside down" by the dredging process, removing all riparian and upland vegetation, and converting finer grained substrates to piles of cobbles unsuitable for revegetation. These dredger tailings confined Clear Creek in some locations, and in other locations, discouraged the natural recovery of riparian and upland plant species. Commercial instream aggregate mining was prevalent through the mid-1980's (Figure 2). Aggregate mining is now conducted well outside of the floodway on old terraces north of Clear Creek Road. Instream mining destroyed the natural channel and floodplain morphology, removed most of the gravel within a 3-mile reach, exposed the channel bed surface to the underlying clay hardpan (Figure 3), and left large pits separated from the stream by small gravel berms (Figure 4). High flows in 1983 and 1986 permanently breached these pits, creating poorly draining areas that stranded both adult and juvenile salmonids.

Additional ecological degradation occurred in the Lower Clear Creek Watershed when Whiskeytown Dam was completed in 1963 at river mile 18 as part of the Trinity River Division of the Central Valley Project. Water releases into Clear Creek below the dam have reduced stream flow by 60% of unimpaired conditions. The magnitude of common floods (2-5 year recurrence) has been reduced by approximately 60%, and all coarse and fine sediment from the upper watershed is now trapped by the reservoir. Large floods (10-20 year recurrence) still occur occasionally, but are less frequent than under the natural flow regime. The channel morphology below the dam changed in the following ways: gravel bars became less pronounced, the bed surface coarsened, salmonid spawning habitat became degraded, and riparian vegetation encroached along the channel margins. Essential geomorphic processes such as sediment transport, channelbed scour and deposition, and channel migration have been severely impaired by the management of the flow from Whiskeytown Dam. These processes are critical components in creating and maintaining dynamic channel morphology, high quality salmonid habitat and riparian vegetation.

Research on the drainage system supports both the historical origins of the problem and the solutions identified by the Lower Clear Creek Floodway Rehabilitation Project. Support documentation includes the Lower Clear Creek Watershed Analysis (WSRCD, 1996) California Department of Fish and Game (CDFG) memorandum (Coots, 1971), the Clear Creek Fishery Study (CDWR, 1986), the Lower Clear Creek Floodway Rehabilitation Project, Channel Reconstruction, Riparian Vegetation and Wetland Creation Design (McBain and Trush, 2000) and the Final Geomorphic Evaluation of Lower Clear Creek Downstream of Whiskeytown Dam, California (McBain and Trush, 2001).

Beginning in 1998, multiple agencies concerned about Clear Creek formed the Clear Creek Restoration Team (Restoration Team) to plan and implement channel rehabilitation activities in the low-gradient alluvial reach to reverse the impacts of instream gravel mining, dredge mining, and Whiskeytown Dam. The Restoration Team is comprised of representatives from federal, state, and local agencies, who serve as technical advisors on creek restoration planning, design and monitoring. This project, named the Lower Clear Creek Floodway Rehabilitation Project (Project), was designed in 1999 by McBain and Trush, an environmental engineering consulting firm. A three phase project, with phase 3 broken into three components, phases 1, 2A, 2B, and 3A have been funded through multiple agencies and completed. This proposal requests funding to complete the next, and most critical phase, Phase 3B. The timing for this phase is important as a channel incision through an old gravel pit below previously implemented restoration phases (Phase 2 and 3A) has led to the creation of a significant headcut that is threatening those investments. The removal of Saeltzer Dam and extensive gravel injections at numerous sites upstream from the floodplain restoration project are recreating sediment transport processes that will ultimately lead to stability of the lower reaches, once the headcut threatening Phase 2 is eliminated, and an appropriately sized channel is created.

Several phases of project design and construction have been completed with CVPIA and CALFED ERP funding. Phase 1, funded by CVPIA, was completed in October 1998 and began removing material from the Reading Bar dredger tailing borrow site to isolate a large salmonid-stranding mining pit at the Mining Reach south pond complex. Phase 2A, completed in 2000, continued the extraction of borrow material at the Reading Bar site to fill 18.4 acres of off-channel north bank mining pits, re-create floodplains, and revegetate floodplains. Extensive revegetation occurred at both the Reading Bar site and the Mining Reach site. Phase 2B, completed in 2001, continued the floodplain restoration along the south bank and a portion of the downstream north bank, filling 59.5 acres of mining pits to eliminate the worst stranding sites. On-site borrow material was used, and floodplains were revegetated with native flora. Phase 3A, completed in 2002, was the first project phase that involved relocation of the channel itself, which was moved from a channel lined with claypan into an area with deeper alluvium. Only limited structural measures were installed (to prevent recapture of the original channel), and geomorphic monitoring has shown that the channel is now dynamic, functioning as designed (with flows over 3,000 cfs overtopping the constructed floodplain), has even more in-channel anadromous fish habitat than was originally anticipated, a 342% increase in spawning habitat use within constructed reaches (Phase 3A), and reduced stranding of juveniles on floodplains. Phase 3A included 12.9 acres of riparian revegetation on the newly constructed floodplains. To date, revegetation of constructed floodplains has increased habitat for riparian-dependent avian fauna including five California Partners in Flight Riparian Focal Species, and two California Department of Fish and Game Species of Special Concern (CDF&G and PRBO 2003). In 2004 proportional nest success for riparian focal species was higher on restoration plots than on reference sites in the watershed (Burnett and Harley, 2004).

c. Goals and Objectives: This proposal requests funding to complete Phase 3B of the Lower Clear Creek Floodway Rehabilitation Project. This phase will reconstruct the bankfull channel and portions of floodplain along 0.9 miles in the center of the restoration project area in one construction season, as well as monitor project implementation

for three years. The reconstructed bankfull channel is designed to function geomorphically within newly constructed floodplain surfaces completed in Phases 2A and 2B of the Floodway Project (2000-01), which are immediately adjacent to Phase 3B. Most importantly, the work will address a headcut that has continued to migrate and is now threatening the successful channel and riparian habitat created in previous project phases. This headcut was documented and taken into account with the original design, however, it was anticipated that funding to complete the project would occur in a more timely manner given the identified importance of restoring Clear Creek. The downstream edge of the headcut has now migrated 700 feet upstream since 1998, and the low flow water surface elevation (WSE) in the upstream areas has already been dropped some 2.5 feet in the period. Current drop through the headcut is about 5.5 feet over 650 feet.

The overarching goal for Lower Clear Creek is to re-establish critical ecological functions, processes, and characteristics, within contemporary regulated flow and sediment conditions, that best promote recovery and maintenance of resilient, naturally reproducing salmonid populations and the river's natural animal and plant communities (See Conceptual Plan in Appendix I). This goal was developed by the Restoration Team, and is supported by the Lower Clear Creek Coordinated Resource Management Planning Group (CRMP), the U.S. Bureau of Reclamation (USBR), the U.S. Fish and Wildlife Service (USFWS) and the U.S. Bureau of Land Management (BLM), and is consistent with goals of the CALFED Bay-Delta Ecosystem Restoration Program (ERP), Central Valley Project Improvement Act (CVPIA), and the Anadromous Fish Restoration Program (AFRP). The Restoration Team, comprised of representatives of the USBR, BLM, USFWS, National Marine Fisheries Service (NMFS), Natural Resources Conservation Service (NRCS), CDFG, CRMP, California Department of Water Resources (CDWR), and the Western Shasta Resource Conservation District (WSRCD), have cooperatively developed this Project to improve conditions for salmonids and restore ecological processes and functions degraded by decades of land use, mineral extraction, aggregate extraction, and, the impacts of Whiskeytown Dam.

Objectives of the Lower Clear Creek Floodway Rehabilitation Project are:

- Rehabilitate the channel degraded by historic aggregate extraction in the Mining Reach by reconstructing the bankfull channel and floodplains.
- Restore sediment transport processes, including coarse bedload transport continuity and fine sediment deposition on floodplain surfaces.
- Restore native riparian vegetation on floodplain and terrace surfaces by focusing on species that provide a diverse canopy structure and removing competing exotic species.
- Reduce salmonid stranding and mortality in floodplain gravel extraction pits.
- Improve habitat conditions for native fish and wildlife species, including priority salmonid species of central concern to CALFED, CVPIA, and AFRP programs.

Phase 3B Objectives:
Specifically, Phase 3B of the Project will target the following objectives:

- Re-establish an alternate bar morphology in the Mining Reach, including riffles, exposed gravel bars, and deep pools.
- Design the channel dimensions to transport the channel bed particles at flows slightly less than the anticipated future channel forming discharge (design discharge is 3,000 cfs), allowing coarse sediment to route through the reach.
- Design floodplains to begin to inundate at flows slightly less than the design discharge (3,000 cfs), allowing fine sediments transported in suspension to deposit on floodplain surfaces.
- Promote natural channel migration across the floodway during flows equal to or larger than the design discharge (3,000 cfs flow event). Lateral channel movement is considered a success, not a failure.

- Raise the bankfull channel thalweg at least three feet above clay hardpan to convert most of channelbed back to a gravel and cobble surface.
- Create floodplain micro-topography that simulates observed pre-dam high flow scour channels or abandoned primary channels. Revegetate many of these channels with native riparian vegetation, while leaving some unvegetated to experimentally evaluate whether natural riparian revegetation can occur (seed beds).
- Reduce the particle size in the design bankfull channel to optimize fish habitat by using appropriately-sized borrow materials.

2. Project Justification, Models, and Hypotheses

a. Justification: The Clear Creek project will provide model implementation of the Adaptive Management Process (AMP) by testing the hypothesis that streamflow and sediment can be managed for ecosystem health and function on a highly-regulated river. The careful evaluation of project data and the revisions made as a result of this evaluation will assist CALFED in its work with similar highly regulated Central Valley streams. Using the AMP, the project will provide essential information for balancing continued resource use with the restoration of river ecosystem health.

Historically Clear Creek supported populations of spring-run, fall-run, and late fall-run chinook salmon (*Oncorhynchus tshawytscha*), and steelhead (*Oncorhynchus mykiss*). Spring-run chinook salmon and steelhead were extirpated from Clear Creek as a result of habitat destruction from mining and blocked access by Whiskeytown and Saeltzer dams (Saeltzer Dam was removed in 2000). Clear Creek is now managed for fall, late fall- and spring run chinook salmon, and steelhead. These species are all listed as CALFED "Priority Group I Species", whose management "will require substantial manipulations of the ecosystem" and for which CALFED "takes major responsibility for recovery…" (CALFED ERP Vol. I p. 32). With the removal of Saeltzer Dam in 2000 and subsequent restored access to the upper canyon reaches of Lower Clear Creek, as well as recent re-allocation of higher minimum baseflows, it is a timely opportunity to improve conditions for spring-run chinook salmon and steelhead. To achieve this goal will require (1) improving spawning habitat conditions and rearing conditions in the lower Clear Creek alluvial reaches and (2) reducing juvenile mortality associated with off-channel stranding.

The Project also qualifies as restoration action under Section 3406 of the CVPIA and will complement future restoration actions funded under CVPIA. Additional justification is provided in the Revised Draft Restoration Plan for the AFRP, which places 'High' priority on Action Item 2: "Halt further habitat degradations and restore channel conditions from the effects of past gravel mining."

As mentioned above, the Restoration Team developed the Project to improve the river ecosystem health and anadromous fish production of Lower Clear Creek. The WSRCD and the Lower Clear Creek CRMP developed the Lower Clear Creek Watershed Management Plan, (WSRCD 1998), which identified numerous actions to restore native anadromous fisheries within Clear Creek. The Project is consistent with the vision and goals for restoration established by the CRMP process. Finally, support for the project is also provided by Central Valley Project Water Association, Western Area Power Administration, NORCAL Fishing Guides and Sportsman's Association, Pacific Coast Federation of Fishermen's Associations, Horsetown Clear Creek Preserve, Shasta County, Shasta Tehama Bioregional Council and Shasta College.

Not only is there strong local and statewide impetus for restoring ecosystem elements (channel morphology, sediment transport processes, riparian community) to aid in the recovery of four Priority I salmonid species, but

there is also an exceptional scientific and adaptive management opportunity in Clear Creek to test the hypothesis that streamflow and sediment can be managed on a highly regulated river to successfully restore and maintain channel morphology and fluvial processes, albeit at a smaller scale than existed historically. Evaluating this hypothesis on Lower Clear Creek will help CALFED determine whether this approach to river restoration and management can be successfully implemented on other highly regulated Central Valley streams. This approach, if successful, could provide an ideal balance between continued resource use (for irrigation, power generation, municipal uses) and restoring river ecosystem health. Clear Creek is perhaps one of the best locations to test this hypothesis because of the following exceptional opportunities:

Low Risk of Damage to Human Infrastructure. The entire floodway is essentially free of structural developments that would be negatively impacted by high flow releases, channel migration, sediment transport processes, sediment deposition, and riparian growth. The experimental value of managed high flow releases, large-scale channel reconstruction, and spawning gravel replenishment is therefore quite high.
Government Ownership of Floodway. The BLM and National Park Service own almost the entire floodway, and the BLM is working toward acquiring the few remaining parcels in coming years. Moreover, these lands contain large deposits of dredger tailings, which can serve as a long-term gravel source for mitigating the impacts of Whiskeytown Dam on coarse sediment supply, as well as provide opportunities to widen riparian and associated upland habitat corridors and reduce fragmentation effects.
Restoration can be accomplished quickly. Full restoration of the stream (restoring gravel supply, completing the Mining Reach Floodway Rehabilitation Project) can be accomplished within the next two to three years;
Saeltzer Dam Removal. The removal of Saeltzer Dam in 2000 has facilitated coarse sediment routing through the system and encouraged re-introduction of steelhead and spring-run chinook salmon to the stream.
"Low" overall cost. No water "cost" to the Bay-Delta system is provided, because flow releases into the stream would still be delivered to the Bay-Delta.
Experimental Control. Lower Clear Creek is unique since the reach downstream of Whiskeytown Dam is short (17 miles), has few tributaries, relatively good access, and long-term USGS gauging records, and provides good experimental control during managed flow releases from the dam. Additionally, the upper half of Lower Clear Creek is in a confined canyon reach, and the lower half is a low gradient alluvial reach, thereby enabling researchers to evaluate two types of channel morphologies. Considerable geomorphic monitoring of the stream bas been conducted since 1998.

Completing Phase 3B is a critical component of testing the hypothesis that streamflow and sediment can be managed on a highly regulated river to successfully restore and maintain channel morphology and fluvial processes because it will reverse the extensive downcutting to the clay hardpan and eliminate the coarse sediment trapping characteristics of the Mining Reach due to a lack of natural channel confinement.

Finally if allowed to continue, the relatively rapid upstream migration (about 700' since 1998) of a headcut in the Phase 3B area is now beginning to damage existing restoration investments in the project area and has the potential to substantially damage a significant proportion of the phases that have already been implemented. The headcut area, also known as "Backbuster", is documented in Figures 5 through 12, taken from a presentation to the CALFED Project Amendments Committee in October, 2004.

b. Conceptual Models: The Restoration Team is currently in the process of updating the Ecological Monitoring Plan (monitoring plan) for the Project and has developed new conceptual models (Appendix II) based on prior models, recent CALFED Environmental Water Program (EWP) models, and the results of monitoring data collected to date as part of the adaptive management process on Lower Clear Creek. The models illustrate the current understanding of the Lower Clear Creek system. These models illustrate how changes in resource inputs to

the current system through restoration actions enable natural processes to restore structure and induce positive habitat responses that lead to increases in the diversity and productivity of biotic communities.

The monitoring plan assesses the effectiveness of the Project by evaluating: (1) changes in the structure of the physical channel and floodplains through geomorphic monitoring, (2) the response of anadromous salmonid species to changes in the channel and floodplain, (3) changes in terrestrial habitat through riparian revegetation monitoring including an evaluation of the functional ability of constructed features to naturally recruit vegetation and key physical factors that drive vegetation response and wetland habitat creation, and (4) the response of avian species to changes in terrestrial habitat.

Additional resources used to define the structure of the restoration project has been provided by the conceptual model entitled "Attributes of Alluvial River Integrity" (Appendix II), first introduced for the Trinity River Maintenance Flow Study (McBain and Trush 1997), and later incorporated in the Trinity River Flow Evaluation Study (USFWS and HVT, 1999) and the Habitat Restoration Plan for the Lower Tuolumne River Corridor (McBain and Trush 2000). This model was finally published in the Proceedings of the National Academy of Sciences (PNAS) (Trush et al. 2000). This conceptual model is based on the critical geomorphic and ecological processes that form and maintain alluvial rivers, and can be used to: 1) propose a set of hypotheses (the Attributes) that may be used to improve our understanding of how rivers function; 2) illustrate how human alterations to the environment may have affected the fundamental geomorphic processes of a particular alluvial river; and 3) develop quantitative and measurable restoration objectives.

Based on the Attributes and our current understanding of alluvial rivers, the linkages can be described between physical inputs (e.g. woody debris, streamflow, sediment), physical processes (e.g., sediment transport, bank erosion, fine sediment deposition), habitat structure (e.g., shallow-gradient riffles, well-sorted and clean spawning gravels, riparian vegetation recruitment), habitat responses (habitat connectivity, increased rearing habitat) and biotic responses (e.g., avian nest success, salmonid density-dependent mortality) as shown in the Conceptual Models. Then the effects of dams, streamflow and coarse sediment regulation, mining, and other human alterations can be related to these linkages. In Clear Creek, Whiskeytown Dam has severely reduced woody debris and coarse and fine sediment supply; reduced the magnitude, duration, and frequency of peak flows; and altered seasonal flow patterns. In addition, aggregate mining and gold dredging have reduced coarse sediment supply to the river by removing stored sediment from the channel and floodplain and trapping coarse sediment that is in transport on the streambed. These reductions/alterations in key inputs to the system (i.e., sediment, coarse woody debris and water) have reduced sediment transport, channel migration and avulsion, and floodplain inundation and have resulted in channel incision, bed armoring, channel narrowing (through riparian vegetation encroachment), and the abandonment of pre-dam floodplains. The result of these structural changes is a decrease in the quantity and quality of aquatic and terrestrial habitats, which causes a direct negative response of the populations and species richness of flora and fauna that are adapted and dependent upon a functional alluvial system.

The ecosystem-based approach to restoration stemming from these conceptual models centers on re-establishing the critical geomorphic and hydrologic processes that sustain alluvial rivers. The ERP and Strategic Plan support this by "proposing an integrated-systems approach that attempts to protect and recover multiple species by restoring or mimicking the natural physical processes that create and maintain diverse and healthy habitats" (CALFED Strategic Plan pg 2-6). The Attributes identified above provide a framework of critical processes required to meet this goal, but also provide essential information to management, to be used in an adaptive management framework.

The conceptual models for Lower Clear Creek have several key uncertainties including:

Will a reduced channel and floodplain geometry with smaller particle size and reduced flow regime re-create a dynamic alluvial channel with functional, inundating floodplains?
Will riparian vegetation encroachment within the active channel be scoured by periodic, moderately high events or will periodic mechanical manipulation or a combination of flows and mechanical manipulation be required?
Can high-value wildlife habitat associated with riparian restoration and natural recruitment be recreated off-channel?
Are all aquatic habitat types (e.g. high value wetlands) adequately represented throughout the restoration project?

The Restoration Team, with funding from the CVPIA, is also continuing to develop and refine the Clear Creek Decision Analysis and Adaptive Management Model (CCDAM). This model, developed by ESSA Technologies, is a predictive model that evaluates the effects of restoration activities system-wide. The CCDAM, which includes the development of specific testable hypotheses, will aid in adaptive management experimentation for future phases of restoration and guide management decisions. Monitoring data collected as part of the Project and other phases will increase the model's accuracy and strengthen the validity of its predictions.

c. Hypotheses: Two forms of hypothesis testing will occur: First, evaluate the overall project hypotheses illustrated in the matrix in Appendix II; and second, develop implementation experiments that will maximize learning for similar implementation projects in the CALFED program/study area.

Specific to this restoration project, an overarching hypothesis is: Reconstructing the channel morphology and restoring geomorphic processes will increase the quantity and quality of salmonid (chinook salmon and steelhead trout) habitat within the project study area. The USFWS Instream Flow Branch, under the supervision of Mark Gard, has applied the "2d" Physical Habitat Simulation Model in 2004 to the (implemented) channel relocation phase (Phase 3A) of the Mining Reach, both before and after Phase 3A was complete. This has allowed an evaluation of changes in available salmonid habitat and then track the habitat through time. Field observations of juvenile salmonid habitat use on Clear Creek, as well as recent scientific literature, suggests that complex channel morphology (backwater alcoves, side channels, high flow scour channels, and small ephemeral tributary confluences) provide large amounts of habitat for fry and juveniles. Evaluation of Phase 3A by the USFWS demonstrates how this project has created these types of habitat features and significantly increased the amount and quality of habitat over pre-project conditions. Furthermore, the WSRCD has implemented 3 years of detailed geomorphic monitoring on Phase 3A, which has demonstrated that the project has generally met all design objectives. An updated monitoring plan (originally submitted to CALFED in 2000), and being revised in 2005, (Appendix III) will be testing project-related hypotheses. Additionally the monitoring has been refined as a result of participation in the CALFED Adaptive Management Forum (CALFED, 2003) to include quantified objectives. Tables for each monitoring program are included in Appendix III.

The Restoration Team developed the following broad hypotheses on which project design, monitoring, and evaluation efforts are based. General project-related hypotheses include:
(H1) Reconstructing the channel morphology and restoring geomorphic processes will increase the quality and quantity of salmonid (chinook salmon and steelhead) habitat within the project study area.
(H2) Filling mining pits and restoring bankfull channel geometry will decrease stranding-induced mortality of adult and juvenile salmonids within the project reach, and reduce predation mortality.
(H3) Filling mining pits and restoring bankfull channel geometry will improve upstream migratory passage and survival through the project reach for adult salmon and steelhead.
(H4) Revegetation of reconstructed floodplains will increase the quantity and diversity of native riparian vegetation, as well as terrestrial fauna.

(H5) Reconstructing the bankfull channel and floodplain surfaces at a scale consistent with the post-dam flow regime will increase natural regeneration of riparian species on reconstructed floodplain surfaces.
(H6) Filling mining pits, creating floodplains, and restoring bankfull channel geometry will improve the geomorphic processes responsible for creating and maintaining high quality aquatic and terrestrial habitats.
(H7) Filling mining pits, creating floodplains, and restoring bankfull channel geometry can be implemented in a way that minimized effects to existing wetlands and does not preclude the creation of new wetlands.

There are many sub-hypotheses associated with these fundamental ones, which are listed in Appendix III. The project hypotheses form an important component of a broader hypothesis that restoration is possible on a scaled down dynamic alluvial river under a highly regulated setting. This hypothesis has tremendous implications for all highly regulated alluvial rivers in the CALFED study area and other watershed areas, and Clear Creek provides an excellent location to test this hypothesis.

3. Approach and Scope of Work

a. Approach: The overall project approach to reverse the impact of instream gravel mining and flow/sediment regulation by upstream dams is as follows:

1) Remove dredger tailings (1999-2000) or unmined alluvium (2001-2006) at "borrow" sites in upstream reaches to create functional floodplains;
2) Transport borrow material to instream mining reach to fill pits, create floodplains, and restore channel morphology; and
3) Revegetate both the borrow site and mining reach floodplains and wetlands with native riparian vegetation.

The Project can be subdivided into two components: (1) Floodplain creation where a majority of earthwork is conducted (Phase 1 and 2, completed in 2001), and (2) the channel relocation where the bankfull channel is either relocated or reconstructed (Phase 3). Phase 3 will complete the project by relocating and reconstructing the bankfull channel. The complexity of channel relocation work resulted in Phase 3 being broken into three components:

- Phase 3A (completed in 2002) which restored the channel in the upper quarter of the project area;
- Phase 3B (current funding request) which will relocate the channel in the middle of the project site, and
- Phase 3C(potentially to be completed after 3B) will relocate the channel at the downstream end of the site.

As implemented in Phase 2, Phase 3B will use borrow material from unmined areas within, and upstream of, the original project area (Figure 14) in order to expand restoration in the project area, without the need to expend substantial resources in processing historic dredger tailings to remove potential mercury. Restoration activities, including revegetation, for the original dredger tailings borrow site used for Phase 1 and 2A (Reading Bar), was completed in 2002. Revegetation of native riparian vegetation will again occur during Phase 3, with continued co-reliance on designing the project to maximize natural regeneration.

b. Scope of Work: As portions of the Project have been implemented, peer review, monitoring observations, and new design ideas (hypotheses) are incorporated into the latest Phase to be implemented through an adaptive management process. For example, the Phase 2B and 3A revegetation designs incorporated several design improvements based on collaboration with Point Reyes Bird Observatory (PRBO) to address the needs of avian species (including some that are MSCS species), while additional backwater elements were added into Phase 3A after input from CDFG and members of the Adaptive Management Forum panel. These subtle design improvements could continue to occur during Phase 3B implementation and will serve as experiments for adaptive management.

The components of the Phase 3B scope of work will include:

1) Relocate and raise bankfull channel in the middle of the mining reach, obtaining material from on-site, unmined borrow areas (unmined status as determined by a certified geologist), and
2) Revegetate floodplains and wetlands at both the borrow and channel relocation portions of the site (earthwork implemented in Summer 2006, riparian revegetation implemented in Fall 2007)

Specific implementation tasks include:

1) Project management. The WSRCD will provide overall project management for all components of the project.
2) Collect additional topographic and clay hardpan data. Identify the location and elevation of clay hardpan throughout the project area in greater detail, and conduct ground topographic surveys to generate more accurate earthwork computations.
3) Refine the Phase 3B earthwork design. Incorporate information and experiments developed from monitoring Phase 2A, 2B, and 3A implementation into Phase 3B designs. Document design revisions and experiments to be conducted as part of the design.
4) Obtain necessary permits and conduct ESA consultations. The 'Final CEQA/NEPA Mitigated Negative Declaration and Finding of No Significant Impact' and the Reclamation Board permit were prepared for the entire project and provide compliance for the entire Phase 3 and will be amended. Other permits will be obtained from appropriate agencies for Phase 3B, and ESA consultations will be conducted with NMFS and USFWS, as appropriate.
5) Develop final grading plans, construction specifications, construction plan, and water quality control plan. Based on the design revisions above, grading plans and construction specifications for Phase 3B will be prepared.
6) Prepare bid package, solicit bids, award contract, and implement earthwork design. Floodplains will be constructed from a combination of un-mined, on-site borrow material and on-site topsoil sources; the bankfull channel will be constructed from cleaned and sorted gravels (1/4-inch to 6-inch diameter) imported to the project site.
7) Revegetation design. A site assessment will be conducted of the constructed floodplains including excavation of soil pits to characterize textural stratification and subsurface hydrologic conditions. Monitoring wells will be installed in a subset of the pits and monitored for one growing season to characterize hydrologic fluctuations. Revegetation design plans will be prepared along with planting specifications.
8) Prepare bid package, solicit bids, award contract, and implement riparian design. Riparian revegetation plantings will include locally-obtained cuttings (willows, cottonwoods, mulefat, etc.), locally-obtained seeds (valley oak, native grasses, etc.), and nursery stock grown from locally-obtained seed (white alder, Oregon ash, sedges, mulefat, etc.).
9) Construction management and supervision. The WSRCD will conduct construction management and supervision on a daily basis for both the earthwork and riparian revegetation component of Phase 3B implementation.
10) Implement monitoring. The monitoring plan for the Project was developed for all phases of the project. It was originally submitted to CALFED in 2000 as part of the ERP Funding Requirements and is currently undergoing revision (2005). The monitoring plan has been implemented as part of Phases 2A, 2B, and 3A and includes elements for geomorphology, fisheries, riparian vegetation and avian species. Monitoring will also include mercury and wetlands, components that are being developed as part of the revision of the current monitoring plan.

11) Irrigation and Maintenance. The WSRCD will irrigate and do maintenance on selected sections of the riparian revegetation component of the project for three years after completion of the riparian revegation section of the Project.

Survey and designs, which are presented as Tasks 1, 2 and 4 (See also figures 13 through 21), are being funded by USBR and will be completed by late summer, 2005.

4. Feasibility

The project approach, as presented in the previous sections and supported by the Conceptual Models for Lower Clear Creek, was developed by local stakeholders, resource agencies, and the Restoration Team as the most feasible and appropriate restoration approach available. Large-scale reconstruction of the Lower Clear Creek floodway has the highest probability of achieving the project goals of re-establishing the critical ecosystem components within contemporary regulated conditions, and it is essentially the only approach that is self-sustaining in the long-term.

Designs for the entire Project were completed under contract with USBR in 1999 to ensure a comprehensive design prior to implementing any single phase. This design is presented in the Lower Clear Creek Floodway Rehabilitation Project; Channel Reconstruction, Riparian Vegetation, and Wetland Creation Design Document (McBain & Trush, et al. 1999) (Appendix IV.). This document was peer reviewed, and Phases 2A, 2B, and 3A have been successfully implemented. WSRCD, the Restoration Team, the Project Consultant Team (Graham Matthews & Associates, Souza Environmental Solutions and PRBO), and the USBR have demonstrated the ability to successfully plan, design, implement and monitor large-scale restoration projects, both in a timely manner and within budget.

If awarded the requested directed action funding, the Restoration Team and the WSRCD will implement Phase 3B construction in 2006 and riparian revegetation in 2007, with 3 years of post-construction monitoring following implementation. This timeline is consistent with other phases and from recommendations of previous Project monitoring. Additionally all work for the Project is on lands managed by the BLM, one of the lead Federal agencies for this project, and is consistent with their management plans for Lower Clear Creek.

5. Environmental Compliance and Permitting

The Project is subject to all local, state, and federal environmental regulatory requirements. The USBR, BLM, and WSRCD, as Co-Lead Agencies, submitted for public review a Joint Proposed Mitigated Negative Declaration/Finding of No Significant Impact and Initial Study/Environmental Assessment for the Lower Clear Creek Floodway Rehabilitation Project (IS/EA) in September 1999. The IS/EA encompassed all project boundaries and identified all potentially significant impacts associated with the proposed Phase 3 Project with the exception of the 3A borrow area. An updated and expanded wetlands delineation of the project area is being completed and a biological assessment will be completed by federal lead agencies to meet the requirements of the federal Endangered Species Act (ESA).

Implementation of each successive phase is dependent on the production and review of final designs. Final geomorphic design review is provided by the Restoration Team, as well as an independent engineering entity. Final geomorphic designs are prepared by Graham Matthews & Associates under a separate contract with the USBR. Final revegetation designs will be prepared by Souza Environmental Solutions and reviewed by the Restoration Team.

In addition to environmental compliance documents, numerous permits are required for the Project. CEQA/NEPA compliance will be amended and the Reclamation Board permit were completed prior to Phase 2 for the entire project and do not need to be repeated for Phase 3. Permits required for Phase 3B are listed below:

Temporary Entry Permits from landowners
RWQCB 401 Waiver
NEPA Document
CEQA Document
Endangered Species Act Consultation (NMFS)
Endangered Species Act Consultation (USFWS)
California Endangered Species Act (CESA) (DFG)
Army Corps of Engineers Nationwide Permit

The WSRCD has successfully obtained permits for all previous phases of the Project (Phase 2A, 2B, and 3A). Phase 3B is very similar in design and construction techniques to phase 3A , therefore it is unlikely that any difficulties will be encountered in obtaining permits for the next phase of the Project.

6. Performance Measures

In response to requirements of the CALFED 1998 Proposal Solicitation Package, a comprehensive monitoring plan was prepared by the USBR and WSRCD in 2000. The monitoring plan was originally submitted to CALFED, and is currently being updated for CALFED review. The monitoring plan (Appendix III.) presents project goals and objectives, and specific monitoring objectives for avian, fisheries, geomorphic, and riparian vegetation components that are intended to address those stated project objectives. Project performance monitoring efforts will include several local, state, and federal resource agencies, non-profit organizations and consulting firms, academic institutions, and resource volunteers working cooperatively under the guidance of the WSRCD, USBR, USFWS, BLM, and CDFG. Fishery resource monitoring elements will be conducted by USFWS offices in Red Bluff and Sacramento. The WSRCD will be responsible for implementing monitoring elements for the remaining three elements through identified and qualified subcontractors. A mercury monitoring component has also been developed with assistance from CBDA staff, information from the Draft Mercury Synthesis and Data Summary Report for Lower Clear Creek (Tetra Tech, 2005), and the Environmental Mercury Laboratory at UC Davis. Monitoring will assess potential project impacts and provide adaptive management feedback for both the Project and the Bay Delta. Mercury sampling is divided into 2 separable components: total mercury load and biosentinel mercury monitoring.

The purpose of the total mercury load monitoring is to determine whether restoration activities on Lower Clear Creek are contributing to downstream loads of mercury and to estimate loads to downstream waterbodies. To accomplish this, Tetra Tech, Inc. will monitor storm events to capture mercury and particle transport when the majority of the sediment transport occurs for three years after completion of instream channel work. Low flow events will be sampled to assess baseline transport of mercury. One floating event will be used to collect data during dam overflow spills or planned pulse flows. Tetra Tech has over 30 years experience in the development of innovative and scientifically accurate approaches to assess complex environmental issues, has led the City of San Jose technical team for the TMDL for copper and Nickel in the in the South San Francisco Bay and is conducting technical studies that will provide the basis for the development of a mercury TMDL for the Guadalupe River Watershed. A monitoring approach is presented in Appendix III.

The biosentinel approach to mercury monitoring has been recommended to the California Bay-Delta Authority (CBDA) in the Mercury Strategy (Weiner et al, 2003) as the optimal approach for measuring the key parameter of concern: relative methylmercury exposure. Young-of-year fish and certain invertebrates can provide accurate measures of this exposure through their bioaccumulation of methylmercury. Sampled carefully, these "biosentinels" can provide precise, statistically differentiable measures over time and between locations. In the

Clear Creek restoration work, as in most aquatic restorations in California, there is a need to measure the potential change in the production of methylmercury stemming from restoration actions. Monitoring of appropriate biological indicators will track the trend in relative methylmercury exposure and bioaccumulation in and around these sites.

Meythlmercury bioaccumulation will be studied by the Environmental Mercury Laboratory at UC Davis, who has specialized, since 1991, in the research and monitoring of food chain methylmercury bioaccumulation. Over the years Environmental Mercury laboratory has refined the use of these "biosentinel" organisms such that they can provide fine-scale, statistically based measures of spatial and temporal variation. In research funded by the State, they have demonstrated strong statistical linkages between mercury levels in these test organisms and (1) mean methylmercury concentrations in the water and (2) mercury concentrations in corresponding large sport fish of human health concern. So, appropriate biosentinels sampled carefully can provide an integrated measure of local, recent aqueous exposure that also corresponds to sport fish mercury bioaccumulation. US Fish and Wildlife Service has already determined that two small fish species are present across all or nearly all of the regions of focus: mosquitofish (*Gambusia affinis*) and California roach (*Hesperoleucas symmetricus*). Both can be useful biosentinels, based on prior work, particularly the California roach. Well developed techniques (Appendix III) will be used to monitor methylmercury exposure in relation to current and ongoing restoration efforts in the Clear Creek watershed.

Annual monitoring reports summarizing the results of all sampling conducted during the previous year will be provided by both elements. Annual reports will provide data tables and the results of statistical analyses to assess impact of the restoration project. Recommendations for any changes in the monitoring program will also be provided that will feed directly back into the adaptive management feedback loop for Lower Clear Creek. Additionally, information from this monitoring can be utilized in other Bay Delta watersheds where mercury is a concern, particularly when associated with restoration efforts.

The proposed mercury monitoring for Phase 3B is directly in line with the core components of the Bay Delta Mercury Strategy and addresses multiple management goals within the core components. Further, findings and recommendations from in the monitoring programs will guide future restoration on Clear Creek by developing adaptive management opportunities that will feed directly back into future restoration planning and design. Additionally, information from this monitoring can be utilized in other watersheds within the Bay Delta where historical mining has made mercury a concern during watershed management and restoration.

In addition to the overall monitoring plan, a more detailed Channel Monitoring Methods for the Lower Clear Creek Floodway Rehabilitation Project was prepared in 2001 as part of the geomorphic valuation of Lower Clear Creek report, which (1) increases the monitoring specificity and details presented in the monitoring plan, (2) provides a detailed description of the methods required to complete the geomorphic, hydrologic, and streambed monitoring tasks for Phases 2 and 3, and (3) provides a detailed description of materials and techniques to be used as a guide for implementing field monitoring programs described in the monitoring plan.

The monitoring activities outlined in these documents will be used to evaluate design performance (e.g., are the floodplains designed at the proper elevations such that they are inundated by 3,000 cfs?) and project performance (did the stream stay at grade and not downcut back down to the clay hardpan?). The details in how these performance measures will be measured are in the monitoring plans, and will be evaluated by a combination of monitoring during high flow events (mostly targeting design performance), as well as long-term monitoring of channel morphology, riparian revegetation, fish habitat and use, and bird use (targeting project performance).

Monitoring of the project is essential to assess the success of the project and strengthen the future implementation of projects through the adaptive management feedback loop. Additionally, monitoring data can contribute to CALFED ERP's goals, milestones, and objectives and benefit other restoration projects in the Bay Delta system.

7. Data Handling and Storage

Because of the size and complexity of the various phases of restoration (planning, design, implementation, monitoring), a large volume of data and project-related information is being generated. Quality Control/Quality Assurance and information availability are important components of the data handling and storage. Data handling and storage is being coordinated by WSRCD with data components located at the appropriate agency office. All data from earlier phases of the Project have been stored in Microsoft Word, Microsoft Excel, and AutoCad Land Development Desktop 2 software. All design documents produced to date have also been saved in PDF format for ease of viewing and sharing. The USFWS collects and stores monitoring data on items such as fish counts, spawning habitat, and fish passage. WSRCD compiles monitoring data on project design, riparian revegetation and monitoring, and geomorphic components, including coarse sediment mobilization, channel morphology, fine sediment deposition, channel profiles, channel dimension evolution, mapping vegetation success, and restored floodplain cross sections. WSRCD will be the central clearinghouse for reports and data, although most reports are accessible in the Watershed Information Model (WIM) developed by the WSRCD with funding from the Department of Water Resources. WIM is an interactive website that provides maps, information and documents in an easy to access and use format (http://wim.shastacollege.edu).

8. Expected Products/Outcomes

With the significant investments being made on Lower Clear Creek by CALFED and CVPIA, it will continue to be, the focus of field tours, seminars, and informational brochures. Lower Clear Creek h will continue to be, the focus of extensive scientific monitoring and experimentation, seminars, and informational brochures.

Five monitoring components will release reports (avian, geomorphic, riparian, fisheries and mercury) will be reviewed and released to guide future restoration actions on Lower Clear Creek and within the Bay Delta system. A total of 15 individual annual monitoring reports and one comprehensive report will be generated and published on the web through The Watershed Information Model (http://wim.shastacollege.edu/).

A comprehensive workshop will be held each year to inform restoration teams working on other projects in the Bay Delta of the progress at meeting the goals and objectives of the project, and will include the solicitation of their recommendations, and as well as a detailed discussion of the issues faced by project staff. Each monitoring team may also provide presentations at CALFED conferences and through other scientific venues, such as professional conferences and journals.

9. Work Schedule

Project implementation will begin as soon as funding is awarded and continue for five years, until December 2010. A timeline in calendar years that represents the beginning and ending of work for each task per year is included in Appendix VIII. Each component is separable by task, as indicated in the graphics. Channel designs for the project will be completed by July 2005 and coordination for NEPA/CEQA compliance has begun. Construction would begin in the summer of 2006. Riparian revegetation would be completed in fall of 2007 to allow time for proper design of riparian revegetation based on a site assessment of the newly created floodplains. Geomorphic and fisheries monitoring would begin in the summer and winter of 2006 and continue for three years. Avian and riparian revegetation monitoring would begin in spring/fall of 2008 and continue for three years.

B. Applicability to CALFED Bay-Delta Program ERP Goals, the ERP Draft Stage 1 Implementation Plan, and CVPIA Priorities.

1. ERP and CVPIA Priorities

This proposal directly addresses ERP goals, ERP Draft Stage 1 implementation Plan, CVPIA priorities. Draft Stage 1 priorities addressed by the Lower Clear Creek Floodway Rehabilitation Project fall within the 'Restoration Priorities for the Sacramento Region' of the Draft Stage 1 Implementation Plan, and includes several of the Stage 1 priorities:

Restoration Priority 1: *Develop and implement habitat management and restoration actions in collaboration with local groups, such as the Sacramento River Conservation Area Non-Profit Organization.* This Project has been conducted in collaboration with the Lower Clear Creek Coordinated Resource Management Planning (CRMP) Group, the Shasta-Tehama Bioregional Council, Shasta Fly Fishers, NorCal Fishing Guides & Sportsman's Assn., Shasta Sportsman, Shasta College, Horsetown Clear Creek Preserve, Shasta Historical Society, Whiskeytown Environmental Education Camp, Shasta Paddlers, Native Plant Society, Shasta County Farm Bureau, Shasta Wildlife Rescue, Redding Mountain Bikers, Black Powder, and the Redding Rancheria.

Restoration Priority 2: *Restore fish habitat and fish passage particularly for spring-run chinook salmon and steelhead trout and conduct passage studies.* CALFED, CVPIA and other government agencies have invested heavily in the return of spring-run salmon and steelhead access in Clear Creek, including funding for removal of Saeltzer Dam in 2000. With this migration barrier removed, spring-run salmon can over-summer in deep, cold-water pools in the Clear Creek canyon reaches below Whiskeytown Dam. Gravel augmentation is providing needed spawning habitat for these species. The potential increase in spring-run chinook salmon and steelhead fry production in reaches upstream of Saeltzer Dam could be limited by rearing habitat in those reaches. The Project may provide additional rearing habitat for all species and potential spawning habitat for steelhead, by restoring the pool-riffle morphology in the 1.8-mile project reach. In addition, floodplain restoration and scour channel construction should greatly reduce juvenile mortality caused by stranding in off-channel pits during high flows. Collectively, these project objectives could benefit spring-run chinook salmon and steelhead production from the Clear Creek watershed.

Restoration Priority 3: *Conduct adaptive management experiments in regard to natural and modified flow regimes to promote ecosystem functions or otherwise support restoration actions*. While the Project does not target experiments with different flow regimes, it is conducive to monitoring the effects of high flows that result from natural floods as well as dam releases. Additionally there is the potential for CALFED EWP flows to be released on Clear Creek, which would be captured as part of the monitoring efforts. The project is testing whether fluvial processes can be restored in a highly regulated river such as Clear Creek at a smaller scale than existed naturally, as a strategy to restore and maintain channel morphology, riparian vegetation, and salmonid populations.

Restoration Priority 4: *Restore geomorphic processes in stream and riparian corridors.* The Clear Creek Floodway Rehabilitation Project is founded fundamentally on the goal of re-establishing ecological processes as the most effective way to maintain the river ecosystem. Additionally, gravel augmentation may help restore sediment transport in Lower Clear Creek.

Restoration Priority 5: *Implement actions to prevent, control and reduce impacts of non-native invasive species in the region.* This proposed project will monitor non-native invasive plant species in order to provide information necessary to implement measures to control existing populations and prevent colonization in the restored areas. The Floodway Rehabilitation Project has restored native riparian vegetation to approximately 47 acres of floodplain that was highly degraded by aggregate and dredger mining. Portions of the restored floodway contain Tree of Heaven (*Ailanthus altissima*), black locust (*Robinia pseudoacacia*), scarlet wisteria (*Sebania punicia*) and Himalayan Blackberry (*Rubus discolor*) that are monitored with funding from BLM. Replanting soon after construction with native riparian canopy and understory species increases the opportunity for native vegetation to

become established and reduces the opportunity for non-native invasive species to spread within the Clear Creek floodway.

CVPIA Priorities: The general purposes of the CVPIA are identified by Congress in Section 3402(a) to "protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California." Section 3406 (b) 12 describes specific actions to be implemented in Clear Creek, including the development of a comprehensive program to provide flows to restore salmon and steelhead habitat below Whiskeytown Dam. The Lower Clear Creek Floodway Rehabilitation Project, in part, will allow the development and implementation of this program by completing channel restoration.

MSCS Big R Species: This project will monitor actions taken to promote the ecosystem recovery of three Multi Species Conservation Strategy Recovery species, Central Valley spring run chinook salmon (Oncorhynchus tshawytscha), Central Valley fall/late-fall-run chinook salmon (Oncorhynchus tshawytscha) and Central Valley steelhead (Oncorhynchus mykiss).

ERP Restoration Program Milestones for the Sacramento River Basin: This proposal measures progress toward ERP milestones in ecological processes, habitats and stressor reductions, including coarse sediment supply through the implementation of gravel augmentation and the assessment of natural sediment transport processes linked to stream channel maintenance, erosion and deposition, maintenance of fish spawning areas and regeneration of riparian revegetation. Two separate milestones for riparian habitat are measured with this project: first, the development of a program to establish, restore and maintain riparian habitat, improve floodplain habitat, salmonid shaded riverine habitat, and, second, the restoration of a portion of the two miles target of riparian restoration along the lower reaches of Clear Creek. Both of these expected habitat milestones can be directly measured by monitoring of the Lower Clear Creek Project. ERP stressor milestones of unimpeded upstream passage and stranding are directly addressed by monitoring of this project being completed by the USFWS.

2. Relationship to Other Ecosystem Restoration Actions, Monitoring Programs, or System-wide Ecosystem Benefits:

Lower Clear Creek is the upstream-most major tributary to the Sacramento River and is situated in an ideal location for adaptively managed restoration. With ample streamflow available from the Trinity Mountains and from the Trinity River Division of the CVP, the opportunity to experiment and learn from the Clear Creek restoration program is tremendous. With Saeltzer Dam now removed, an experienced stakeholder group in place, spawning gravel augmentation and other rehabilitation efforts established, and with relatively low risks due to public ownership and the general lack of development within the floodway, Lower Clear Creek has potential to be a model restoration river for CALFED and CVPIA programs.

The highest priority action for Lower Clear Creek is, therefore, to complete the Project, in a manner that both maximizes the opportunity to gain valuable information, but achieves the goal expediently. As emphasized throughout this proposal, information gathered from this project and the Clear Creek restoration program in general can be extrapolated to restoration efforts throughout the Central Valley. The Project addresses those components. For example, Clear Creek has excellent remnant riparian forest and the potential for high quality, non-fragmented riparian and upland habitat for riparian obligate species. While it has managed flows, it still experiences high flow events that affect the floodplain and allow for some level of natural successional processes to take place (such as floodplain inundation). It provides all components of the life history of anadromous fish populations (3 chinook runs and steelhead) with the potential to improve that even further. While Non-native Species (NIS) are present, these are not at a magnitude found on other streams (such as Stony Creek), so there is high potential to control the level of negative impacts from those species. It provides a valuable resource for environmental education to locals,

including children/students. There are some localized potential impacts caused by development, however, and the ongoing issue of how to most effectively deal with mercury is being actively addressed.

Clear Creek also was a major supplier of coarse sediment to important spawning reaches in the upper Sacramento River mainstem, estimated to be 5,000 tons/yr (CALFED ERP Vol. II). Finally, Lower Clear Creek supports the only known breeding populations of Yellow Warblers (*Dendroica petechia)* and Song Sparrows (*Melospiza melodia)* in proximity of the Sacramento River to function as a source population. Increasing habitat for these species along Clear Creek is a high riparian restoration priority for the revegetation design and for the California Partners in Flight and The Riparian Habitat Joint Venture (RHJV 2000).

As with most large restoration programs, prioritizing the activities to implement in a logical method is a challenging task. The Floodway Rehabilitation Project, however, is perhaps the highest priority action necessary to improve ecological functions and salmonid populations in Clear Creek. With removal of Saeltzer Dam complete, migratory access to the upper canyon reaches in Lower Clear Creek is restored. Additionally, the USBR and WSRCD have also been implementing a program to place large volumes of spawning gravel in the channel, both below Whiskeytown Dam, and in downstream alluvial sections below the former Saeltzer Dam site. These projects are improving stream corridor conditions in Clear Creek. The next priority is the completion of restoration of the bankfull channel and floodway within the Project area reach, particularly as headcut migration in the current channel at Phase 3B is threatening restoration investments made to date.

3. Request for Next-Phase Funding

This proposal requests next-phase funding to complete Phase 3B of the Lower Clear Creek Floodway Rehabilitation Project. Phase 1 constructed a large berm to isolate salmon from a pond on the south side of Clear Creek that was identified as the largest stranding problem, and was completed in 1998 based on designs developed by McBain & Trush, Graham Matthews & Associates, and North State Resources under a contract with the USBR. The original CALFED funding proposal for the project was submitted by the WSRCD. Substantial funding ($3,559,596, managed by USFWS) was awarded to complete the preliminary design of the entire project and to implement Phase 2 of the project. Phase 2 was split into 2A and 2B. Phase 2A filled one large gravel extraction pit to recreate/rehabilitate 18.4 acres of floodplain, and construction was completed in 1999. Revegetation was completed in 2000. Pits were re-filled with gravel obtained from the Reading Bar borrow site. Phase 2B, implemented during summer 2001, continued floodplain rehabilitation by filling an additional two ponds to recreate/rehabilitate 57.3 acres of floodplain, primarily on the south side of the stream. Revegetation followed construction in 2002, in a manner similar to Phase 2A.

Phase 3 completes the channel and floodplain rehabilitation effort by relocating and reconstructing the bankfull channel. Phase 3 is broken into three components: Phase 3A was completed in 2002 with remaining funds from Phase 2 ERP funding (due to cost effective implementation) and relocated the channel in the uppermost 1,500 ft of the project site; Phase 3B will relocate the channel in the middle of the project site; and Phase 3C would relocate the channel at the downstream end of the site.

4. Previous Recipients of CALFED Program or CVPIA Funding

The WSRCD has successfully completed and/or is completing the following restoration efforts in Lower Clear Creek and Shasta County.

a. CALFED No. 98-F15 for Phase 2 and Phase 3A of the Lower Clear Creek Floodway Rehabilitation Project. Total funding: $3,559,596. All construction for this project has been completed in 2003, the grant has been increased to $4,003,239.58 and extended for additional monitoring of project performance.

b. CALFED No. 99-N16 Clear Creek Prescription. Total $256,260. Grant Completed on 2003
c. CVPIA No. 6-FG-20-14240l for Lower Clear Creek CRMP Organization. Total $55,700. Grant completed in 2001.
d. CVPIA No. 7-FG-20-14560 for LCC Erosion Inventory. Total $197,752. Grant Completed in 2001.
e. CVPIA No. 7-FG-20-15290 for LCC Spawning Gravel $408,000. Grant completed in 2000
f. CVPIA No. 7-FG-20-14610 for LCC Fuel Inventory $15,111. Grant completed in 1998.
g. CVPIA No. 7-FG-20-14720 for LCC Photogrammetry Survey $39,087. Grant completed in 1997.
h. CVPIA No. 00-FG-200079 for LCC Spawning Gravel $325,000. Grant completed in 2003.
i. CVPIA No. 00-FG-230718 for LCC Spawning Gravel $98,851. Grant completed in 2001.
j. CVPIA No. 01-FG-230725 for LCC DVD $7,395.00 Grant completed in 2002.
k. CVPIA No. 01-FG-200131 For LCC Phase 3 and 4 Design $115,000. Grant completed in 2002.
l. CVPIA No. 02-FG-230736 For LCC CRMP $19,744. Grant completed in 2003.
m. CVPIA No. 03-FG-200008 For LCC Spawning Gravel $75,000. Grant completed in 2003.
n. CVPIA No. 03-FG-200008 For LCC Spawning Gravel $140,000 Grant completed in 2004.
o. CALFED No. 03-075-555-0 For LCC Spawning Gravel $335,489. Grant 75% completed
p. CALFED No. 04-162-555-0 For County ecosystem improvements $821,727.00 Grant 25% complete
q. CALFED No. 46-0000-1797 Shasta West Watershed Assessment $131,600. Completed in 2005.
r. CALFED No. 03-074-555-0 Bear Creek Watershed Assessment $140,806. 75 percent complete.
s. CALFED No. 03-106-555-0 Cow Creek Water Quality $67160. Grant 50% complete.
t. CALFED No. 46-0000-1798 Watershed Information Model $378,899. Grant completed in 2005.

5. Additional information for land acquisition

All of the property contained within the project area is owned by the BLM, and no properties are proposed for purchase as part of this proposal.

6. Qualifications

a. Principal Participants

Western Shasta Resource Conservation District

Mary Schroeder, District Manager, received a B.S. degree in Forest Industries Management from The Ohio State University, Columbus, Ohio. She has over 25-years business management experience in natural resource and wood products industries. As chief administrative officer of the District, Mary is responsible for directing the District's business and field operations consistent with the strategic plan.

Michael Harris, Projects Manager for watershed restoration, fisheries, and wildlife. He has a B.S. in Biology from California State University-Sacramento, and a B.A. in Economics from the University of California-Davis, and is completing his Master of Science in Biological Conservation from the California State University-Sacramento. Michael's experience includes habitat sampling; scheduling and data management; vertebrate sampling of mammals, reptiles and amphibians; monitoring of avian species. His publications include 2001 and 2002 California Department of Transportation –Carmel River Mitigation Bank Report. Michael's thesis will be titled "Small Mammal Microhabitat Analysis of a Restoration Site."

Agency Team Representatives

Francis Berg, Assistant Field Manager, Bureau of Land Management, has graduate courses in Environmental Administration and Archaeology from the University of California-Riverside; a B.A. in Anthropology (Highest

Honors, Phi Beta Kappa) from Riverside City College, Riverside, CA; and an Associate of Arts (Greatest Distinction) Francis has been the Assistant Field Manager at the Redding Field Office since 1991. He supervises a team in wildlife, fisheries, botany, range conservation, forestry, archaeology, geology, recreation management and planning, and leads the implementation of the restoration of Lower Clear Creek and sections of the Sacramento River in Tehama and Shasta Counties.

Jim DeStaso, Fisheries Biologist, US Bureau of Reclamation, has a Master's Degree in Zoology and Physiology from the University of Wyoming and a B. S. in Biology from William Paterson University. Jim has worked for the Bureau of Reclamation since 1995 and his responsibilities include project implementation of multi-agency river ecosystem restoration projects, including channel improvements, budget oversight of restoration projects, contract administration and environmental compliance. Jim is a member of the Restoration Team and is a BOR Program and CVPIA Manager for Clear Creek.

Matthew Brown, Fisheries Biologist, US Fish and Wildlife Service, has a M.S. in Biology from Arizona State University and a B.A. in Biology from the University of California-Santa Cruz. His work is focused on Chinook salmon with a concentration on habitat restoration under the CVPIA and evaluating the impacts of water development. Matthew is a member of the Restoration Team and oversees all fisheries monitoring on Clear Creek.

Mike Berry, Senior Fisheries Biologist Specialist for the California Department of Fish and Game. A graduate from the Humboldt State University with a B.S. in Fisheries, Mike worked in Washington State as a fisheries biologist, and for 10 years with California's Wild Trout Program. He is currently working on the recovery of listed anadromous salmonids in the Central Valley including a lead biologist for Lower Clear Creek Floodway Rehabilitation project and CVPIA restorations. He is a member of the Cow Creek Watershed Management Group and the Restoration Team for Clear Creek. His current work focues on management issues for anadromous fisheries and water quality.

Patricia Bratcher, Staff Environmental Scientist, California Department of Fish and Game: Ms. Bratcher is the Habitat Restoration Coordinator for the California Department of Fish and Game on the upper Sacramento River. Her primary responsibilities include: Coordination of the Anadromous Fish Restoration Program; planning for restoration activities on the upper Sacramento River and its tributaries, as well as coordinating efforts with the rest of the Central Valley; interagency and intra-agency coordination; and representing the Department on interagency teams involved with watershed restoration efforts. Ms. Bratcher is also a technical representative with several watershed groups in the upper Sacramento Valley, which includes assisting watershed groups in preparing proposals for funding through CVPIA and CALFED, as well as other funding sources. She has been working within the natural resource field since 1985 and obtained a Bachelor's degree (Magna Cum Laude) in Environmental Biology from California State University, Fresno in 1988.

Consultants

The consultants identified for this project have a proven track record and are the same consultants that have worked on this project in the past.

Graham Matthews, Principal of Graham Matthews and Associates (GMA), has 24 years experience in hydrology and fluvial geomorphology, and 22 years of experience in the design and construction of stream and riparian restoration projects. Graham received a B.A. in Geology from Pomona College (1981) and a M.S. in Earth Sciences from U.C. Santa Cruz in 1990. GMA is a small, diverse consulting firm established in 1990, and consists of hydrologists, engineers, geomorphologists and fish biologists. GMA specializes in: (1) stream restoration

design, implementation and monitoring; (2) hydrologic and hydraulic data collection and analysis; (3) geomorphic data collection and analysis; and (4) hydraulic and hydrologic modeling. The firm has worked on hydrologic/geomorphic issues and stream restoration designs in California Oregon, and Idaho. Recent projects include: 2.5 miles of the Wood River Channel and Wetland Restoration Project (awarded the Grand Environmental Achievement Award by IECA in 2002); Year 2000 Projects for the Williamson River Restoration Project, in the Upper Klamath Basin, OR; Clear Creek Channel Restoration Project Phase 1, 2, and 3A, 3B; the Agency Creek Dam Removal and Channel Restoration Project near Chiloquin, OR, the Angora Creek SEZ Restoration Project in South Lake Tahoe, and a variety of projects on the Carmel River, CA. Many of these projects included the full-range of surveying, design, construction specifications, permits, and construction management. Following implementation, GMA has conducted hydrologic and geomorphic monitoring for many of these projects, including topographic and bathymetric mapping for volume change detection, substrate characterization through surface counts, bulk samples, and permeability, streamflow measurement and gage operation, and sediment transport measurements.

Greg Treber, Principal of Terrestrial Connections, has both a M.S. in Agriculture-Plant Ecology with Natural Resource Management emphasis and a B.S. in Agriculture with a Botany minor from California State University-Chico. He has worked as a Botanist for the U.S. Forest Service and the Bureau of Land Management and has planned, designed and implemented several large scale riparian and wetland restoration project on the Sacramento and San Joaquin Rivers. Mr. Treber has been involved in the annual riparian revegetation monitoring of the Lower Clear Creek Rehabilitation Project since 2002.

Jeff Souza, Principal of Souza Environmental Solutions, has a M.S. in Agriculture with an emphasis on Plant and Soil Science from California State University-Chico, and a B.S. in Environmental and Systematic Biology with a concentration in Fish and Wildlife Biology from California Polytechnic State University in San Luis Obispo. He has over 18 years professional experience in the assessment, restoration, monitoring and project permitting of terrestrial and aquatic habitats associated with stream, riparian, and wetland systems. Jeff has been involved in the restoration of Clear Creek since 1995 and has conducted the annual riparian revegetation monitoring of the Lower Clear Creek Rehabilitation Project since 2002.

Dr. Neil Schwertman, Professor Emeritus, Department of Mathematics and Statistics, California State University, Chico, has a B.S in Mathematics from the U.S. Naval Academy and a Ph.D. in Applied Statistics from the University of Kentucky. He was a Professor in Mathematics and Statistics at CSU, Chico for 28 years and has provided statistical consulting for a wide range of disciplines including Biology, Agriculture, English, Anthropology, Social Welfare and Corrections, and Education. Dr. Schwertman has been providing statistical assistance for the annual riparian revegetation monitoring of the Lower Clear Creek Rehabilitation Project since 2003.

Ryan Burnett, PRBO Conservation Science's Regional Biologist for the Northern Sacramento Valley and Northern Sierra Nevada. Ryan holds a B.S. in Wildlife, Fish, and Conservation Biology from the University of California, Davis. He has over eight years experience designing and implementing avian monitoring projects including working with federal, state, and NGO's to implement riparian, oak woodland, and coniferous forest avian adaptive conservation plans. Ryan is the project leader for PRBO's Songbird monitoring of the Lower Clear Creek Floodway Restoration Project and authored a recently published paper entitled, "Using Songbird Monitoring to Guide and Evaluate Riparian Restoration in Salmonid Focused Stream Rehabilitation Projects**.**

Dr. Darell G. Slotton, (U.C. Davis) has directed applied research projects addressing heavy metal contamination and bioaccumulation issues in California aquatic ecosystems for over 15 years, with a primary focus on mercury.

He has led investigations of copper, zinc, and cadmium contamination at Iron Mountain Mine, Keswick Reservoir, and Camanche Reservoir, where sediment resuspension and metals transport, solubility, and bioavailability were studied. Since 1985, he has run a mercury monitoring and research program at Davis Creek Reservoir and a mercury analytical laboratory at UC Davis. In the 1990s, Dr. Slotton led a research program throughout the gold mining region of the Sierra Nevada, focusing on benthic invertebrates and fish as sentinels of relative bioavailable mercury exposure. He conducted an intensive study of mercury mass loading, bioaccumulation, and remedial options at the Mt. Diablo Mercury Mine and Marsh Creek watershed. Slotton has led numerous mercury studies throughout the Cache Creek watershed and was a long-time participant in the Clear Lake Superfund Mercury Project. Other projects have included mercury bioassessment studies in both lower Putah Creek and its mine-impacted upper watershed. A current multi-year project is researching the mercury issue in the Truckee River and Pyramid Lake, Nevada. International projects include mercury bioaccumulation and source assessment studies in the Lake Titicaca watershed of Peru and the Ayeyarwady River system of Myanmar. Since 1998, Slotton's primary focus has been directing several regional projects funded by the CALFED Bay-Delta Agency (now CBDA). One was a San Francisco Bay-Delta study of mercury source detection, bioaccumulation, and methylation, and the implications for wetlands restoration projects. A second focused on the Cache Creek watershed, determining the trophic relationships in localized mercury bioaccumulation, and the relationship to aqueous mercury chemistry. Another recently investigated the mercury bioaccumulation implications of a potential large dam removal project on the Yuba River. His most recent CBDA project involves the development and implementation of a biosentinel component for the new Bay-Delta watershed-wide fish mercury monitoring program.

Dr. Ted Donn, (Tetra Tech) is a broadly trained ecologist with over 20 years of post-doctoral experience. Dr. Donn managed projects involving evaluation of impacts to water and sediment quality, terrestrial and marine communities, ecological risk assessment, endangered species surveys, and GIS and database development ranging in value from $10,000 to over $750,000. Dr. Donn has extensive experience with water and sediment quality issues in both freshwater and marine systems, mercury behavior in aquatic environments, and restoration of salmonid habitat. He has contributed to the development of TMDLs for nutrients and metals for water bodies in California, Arizona, Colorado, and Florida. Dr. Donn has conducted evaluation of the effects of mercury and other contaminants on benthic organisms and fish in the Gulf of Thailand, in Colorado streams and reservoirs, and in the Everglades. Dr. Donn managed the preparation of a summary report on mercury issues associated with ongoing restoration activities designed to improve habitat for anadromous salmonids in Lower Clear Creek. This project includes the compilation and synthesis of data available in peer-reviewed literature, published reports, and unpublished data sets. Dr. Donn has reviewed marine monitoring data submitted in support of NPDES permits applications (Section 301(h) of the CWA), developed management and monitoring objectives for POTW monitoring programs, and has reviewed the intercompatibility of discharge-related monitoring programs in the Southern California Bight. Dr. Donn was a contributing author to an EPA guidance document on marine and estuarine monitoring methods for the National Estuary Program.

b. Scientific Contributors

The Restoration Team is comprised of representatives of various federal, state and local resource agencies. Although over thirty representatives attend the meetings at various times, the key participants are:

Jim DeStaso, Bureau of Reclamation
Matt Brown, U.S. Fish & Wildlife Service
Howard Brown, NOAA Fisheries
Aric Lester, California Dept. of Water Resources
Francis Berg, U.S. Bureau of Land Management
Graham Matthews, Graham Matthews and Assoc.
Jeff Souza, Souza Environmental Solutions
Jess Newton, U.S. Fish and Wildlife Service
Patricia Bratcher, California Dept. of Fish and Game
Mike Berry, California Department of Fish and Game
Ron Rogers, U.S. Bureau of Land Management
Michael Harris, Western Shasta RCD
Ryan Burnett, PRBO Conservation Science

Geomorphic designs underwent review by the Restoration Team, as well as agency engineering staff as needed. Project designs for Phases 1 & 2 were prepared by McBain & Trush, North State Resources, Graham Matthews & Associates, and Stetson Engineers. Phase 3B geomorphic designs have been prepared by Graham Matthews & Associates. Riparian revegetation designs will be prepared by Souza Environmental Solutions. Construction implementation will be completed by the WSRCD, monitoring and evaluation will be implemented by WSRCD, USFWS, Graham Matthews & Associates, Souza Environmental Services, and PRBO. Adaptive Management will be continued through both the WSRCD and the Restoration Team.

c. Planning Organizations

The WSRCD has been implementing wildlife and fisheries restoration projects, erosion control projects, fuels reduction projects, and coordinated resource planning projects in Shasta County since 1957. In 1999 the WSRCD was named "District of the Year" by the California Association of RCDs. Since 1997, WSRCD has implemented numerous projects on Lower Clear Creek, including spawning gravel introduction, a watershed analysis, and erosion control projects, including all previous phases of the Lower Clear Creek Floodplain Restoration Project. The WSRCD will coordinate the project with the Lower Clear Creek CRMP group and the Restoration Team.

d. Other Collaborators

Other groups who have been contributing to the success of the project, reviewing documents and providing input include the Horsetown Clear Creek Preserve Board of Directors, the Shasta County Office of Education – Whiskeytown Environmental School, French Gulch School and the Shasta-Tehama Bioregional Council. In addition numerous schools collaborate with the Restoration Team by using the project as a learning lab. This includes Chrysalis Charter School which has adopted the project and has integrated restoration into its curriculum.

e. Conflicts of Interest.

No potential conflicts of interest are anticipated.

7. Costs

a. Budget

The total cost for this project is 4,774.622.00 for completion of all tasks. A budget by task and a detailed budget by year is in Appendix VII.

b. Cost-Sharing

COST SHARING COMMITMENTS: The total CALFED project funding commitment to the WSRCD has been 4,003,239.58. Over $1,391,912 cost sharing has been obtained for previous phases of the project and will continue through the end of the total project. To date Phase 3B has the following Cost share commitments in place.

BLM	Invasive Weed Surveys and Treatment	$45,000	
BLM	Elderberry Surveys for Phase 3B	$10,000	
BLM	Wetlands Delineation for Phase 3B	$25,000	
BOR	Biological Evaluation for Phase 3B	$40,000	(Includes NEPA)
CVPIA	Phase 3B Survey and Design	$86,000	
CVPIA	LCCFRP Stream Gage	$20,000.	
		$226,000	

Additional cost share will come from meeting attendance by agency personnel, additional grant sources through the WSRCD, as well as BLM and CVPIA yearly funding allotments for lower Clear Creek.

8. Local Involvement

This project has been presented by the Restoration Team to the Lower Clear Creek CRMP Group, which provides a mechanism for private stakeholder participation and fully supports this proposal. The Shasta County Board of Supervisors has been an avid supporter of the work being done in the Clear Creek Watershed. Periodic reports will continue to be made to the board, and a letter of support is attached. The Shasta-Tehama Bioregional Council, a 12-year old organization of state/federal/local agencies, industry, businesses, conservation organizations, local elected officials, labor, the academic community, and the general public, continues to avidly support the restoration of Lower Clear Creek.

Stakeholder groups continue to be brought into the process through quarterly meetings of the Lower Clear Creek CRMP Group (involving landowners, residents, and any stakeholders interested in activities in the watershed) including Shasta Fly Fishers, NorCal Fishing Guides & Sportsman's Assn., Shasta Sportsman, Shasta College, Horsetown Clear Creek Preserve, Shasta Historical Society, Whiskeytown Environmental Education Camp, Shasta Paddlers, Native Plant Society, Shasta County Farm Bureau, Shasta Wildlife Rescue, Redding Sunset Rotary, Redding Mountain Bikers, Black Powder, Redding Rancheria. Businesses in the CRMP Group include: J. F. Shea Sand and Gravel, Salix Applied Earthcare, Schmitt Equipment Sales, and Sunrise Excavation, Osprey Excursions, and Bob's Guide Service.

9. Compliance with Standard Terms and Conditions

The WSRCD will comply with the state and federal standard terms.

10. Figures and Appendices

A. Figures
B. Appendix
   I. Conceptual Plan for Restoration of the Lower Clear Creek Floodway.
   II. Conceptual Models
   III. CALFED Monitoring Plans and Tables
   IV. Channel Construction Document
   V. Channel Monitoring Methods
   VI. Timeline for Implementation
   VII. Detailed Budget
   VIII. Letters of Support

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