

# **Does It Work? Measuring the Success of Salmonid Habitat Restoration at Multiple Scales**

**Caitlin Cornwall**

# Initial Selection Panel Review

Not Recommended

*Amount Sought:* \$810,324

*Fund This Amount:* \$0

Brief explanation of rating:

This project intends to evaluate the percent of the Sonoma Creek steelhead population that is derived from restored and unrestored reaches of the watershed. Substantial restoration funds have been invested in the watershed. The technical panel rated the proposal inadequate while the regional panel rated the project high. The selection panel does not recommend funding this proposal from this solicitation because Sonoma Creek is not within the Central Valley steelhead ESU. The selection panel noted that the proposed techniques and methods have been applied elsewhere on similar scale watersheds and have provided detectable population responses at this scale. In fact it may be helpful to apply these techniques in the Sacramento/San Joaquin watershed. However, the results of this project may not be directly applicable in the Central Valley, as coastal watersheds line Sonoma Creek function differently than the Central Valley. Other funding sources may be more appropriate given the limited funds available under this solicitation. The panel encourages the applicants to pursue funds from other sources for this proposal, including the Pacific Coast Salmon Recovery Funds.

# Technical Panel Review

*Technical Review Panel's Overall Evaluation Rating:*

Inadequate

## Explanation Of Summary Rating

The Technical Review Panel appreciated the incorporation of reference or control sites and the intent to assess benefits at the scale of the entire watershed. However, the Technical Review Panel concluded that the project is unlikely to succeed because the restoration sites are few and small in comparison to the entire watershed.

## Goals And Justification

The proposal clearly identifies the set of restoration actions whose outcomes will be monitored. This is a potentially important study in that it seeks to evaluate the aggregate success of a total of 14 in-stream structures and a barrier removal within the Sonoma Creek watershed. The proposal provides a clear and internally consistent statement of the goals and objectives of the restoration actions. The Proposal states a list of cogent hypotheses that the monitoring will test. The hypotheses are well justified relative to existing knowledge.

## Approach

The Technical Review Panel commends the authors for incorporation of controls. This is an interesting project aimed at important objectives. The External Technical Reviewers did not identify methodological flaws that they would have deemed sufficiently severe to preclude funding. However, the Technical Review Panel concluded that the limited spatial scale of the restoration action is unlikely to yield detectable responses. The treatment sites are few and small

## Technical Panel Review

relative to the size of the watershed and therefore it will likely be very difficult to detect any signal of a restoration effect. Further, it is possible (and likely) that fish will move between treatment and control reaches. Therefore, the proposed approach will not be able to determine whether steelhead are captured in the reaches where they were reared. The assumption that deep-pool habitat limits production was not justified; the authors noted that their limiting-factor analysis has not been completed.

The proposal builds on previous monitoring efforts. The proposed monitoring activities are likely to make significant contributions to our knowledge base. This proposal seeks to answer the open question of whether the aggregate set of restorations in the Sonoma Creek watershed is having an observable effect. It will do this by documenting the presence or absence of responses over the entire watershed that are consistent with restoration hypotheses. This whole-watershed view is arguably the best measure of restoration. However, that watershed-scale approach depends on the existence of a systemic response that is highly unlikely given the small spatial extent of the restoration actions within the watershed. This study will not identify causal linkages between habitat and production of juvenile steelhead. The Technical Review Panel is concerned about the use of electrofishing to capture this endangered species. There is a large body of peer-reviewed scientific literature that indicates that *O. mykiss* is sensitive to injuries that could bias study results. Untoward electrofishing injuries may also be of serious concern to NMFS and the USFWS.

### **Feasibility And Likelihood Of Success**

The proposed monitoring ACTIVITIES seem technically feasible with the possible exception of the use of electrofishing to capture an endangered species and the untested Vaki system and a back-up plan for those components could prove critical to project success. The Technical Review Panel concluded that the likelihood of success is very low, however, because any effects of the relatively few and small restoration sites will be diluted by the size of the system, and because capture

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sites may be different from rearing sites. The proposal is weak on description of how the linkage from habitat to salmonid response might be made. There are a large number of potential confounding factors that will make confirmation of any such linkage difficult. A more detailed comparison of temporal trends between restored and un-restored tributaries may be useful. The regional review panel did not identify any impediments to success. The environmental compliance review did not identify significant limitations.

### Performance Measures

The data collected by the proposed monitoring would allow partial evaluation of the restoration actions that are being monitored. Specific performance measures are proposed and the rationale for those measures is generally well demonstrated. This proposal will not determine habitat limitation for age 1+ steelhead and the habitat performance measures reflect that. The proposal describes changes in channel morphology as an indicator of restoration success, but the direction of change is not considered. Performance measures relative to any differential response between restored and reference tributaries would be a welcome addition. For example, given time-series of response measures from both restored and reference areas, one can postulate models that are generalizations of analysis of covariance. In those models, the interaction terms between time-trend and site type measure the presumptive effect of the restoration after compensating for any background trend. The monitoring and evaluation plan seems sufficiently detailed relative to its objectives.

### Products

This proposal is unlikely to produce products that are useful to resource managers because the scale of the project (number and extent of restoration sites) is likely inadequate for the objectives. The project makes strong linkages with regional efforts. The project team plans adequate opportunities for local involvement. The proposal explicitly describes how data will be managed, stored and disseminated. The study team plans to pursue publication in the open peer-reviewed scientific

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literature.

### Capabilities

The project team's qualifications seem adequate and their performance record indicates a high probability of success in implementation of the monitoring. The team would be strengthened by addition of a scientist who has a strong publication record. They may be able to overcome any publication challenges through additional collaboration.

### Budget

The budget seemed reasonable and defensible to the External Technical Review Panel.

### Regional Review

The Regional Review Panel gave this proposal a "High" ranking. That panel found the proposal broadly applicable to ERP goals and regional priorities. The panel noted adequate linkages with other restoration efforts and local collaboration. Broad local value was identified, and the panel noted the exceptional importance of the Sonoma watershed. They viewed this as a novel proposal that could have broad value.

### Administrative Review

The budget reviewer did not indicate any significant deficiencies. However, the authors may need to provide more detailed budget information on the tasks and deliverables. The Environmental Compliance reviewer did not identify significant deficiencies. The authors will need to verify NEPA requirements and their State collector's permits.

### Additional Comments

The investigators should at least consider the following ideas for modification of this proposal: 1. Consider expanding topographic monitoring to include measurement of velocity,

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substrate, cover, and development of stage-discharge relationships for each cross-section. 2. Further describe how habitat value might be quantified. 3. Identify the possibility of false-positive PIT-tag detections and describe the dimensions of the PIT tag antennas relative to stream cross sections. 4. Address the potential for electrofishing injury and the consequences of such injuries. 5. Describe any procedures for validating/calibrating the Vaki system. Are there contingencies if the Vaki system doesn't work? Consider redd counts.

# Bay Regional Review

*Bay Regional Panel's Overall Ranking:*

High

## Summary:

It was agreed that this is a novel approach to quantifying the success of these types of restoration projects. The results could show that these projects are a worthwhile investment toward recovering listed salmonids throughout California. The project could serve as a model in other watersheds to evaluate their success and to identify and prioritize their restoration efforts.

### 1. Applicability To ERP Goals And Regional Priorities.

Project evaluates the success of 14 instream fish habitat structures which were at least partially funded via CalFed. NOAA Fisheries has also funded habitat enhancement projects in this watershed through the Pacific Salmon Recovery Fund. The proposal is meant to explore reach-scale and watershed wide scale benefits of these types of projects to the threatened steelhead trout. Although the project location is within the Central California Coast steelhead ESU, it is this ESU that spawns throughout San Francisco Bay tributaries including those to Suisun and Honker Bays. The project is also expected to benefit the endangered California freshwater shrimp which has many of the same habitat requirements. Fall run Chinook salmon, managed under the Magnuson-Stevens Fishery Conservation and Management Act, are also noted in the proposal as using the enhanced pools from the restoration projects. The project will be able to quantify thier numbers in the creek as well. Sonoma Creek has recieved a large number of investments and it has apparently had several projects funded by CalFed within it with a total expenditure of more than \$1.5 million. The results will be of interest to all freshwater, salmonid targeted restoration programs both within and outside of CalFed's purview.

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## 2. Links With Other Restoration Actions.

The purpose of the project is to assess the effects of multiple restoration projects within the watershed including multiple habitat structures installations (anchored logs and boulders) and a migration barrier removal project. A limiting factors analysis for the watershed has been funded by the State Water Quality Control Board which would dovetail with this project. Other activities/partnerships are not mentioned, but this use of PIT tagging is relatively novel particularly in the Bay area. Data and metadata will be available through the San Pablo Bay Watershed Information Systems as well as CalFish and the Natural Resource Projects Inventory. The project should produce valuable information concerning the long-term trends of this type of ecosystem restoration which will be of value to similar restoration projects throughout California.

## 3. Local Circumstances.

I am not aware of any constraints that may affect the project's feasibility. The Sonoma Ecology Center has an excellent reputation and relationship with the surrounding community. They have enviable success in obtaining permission for access to private property. The project is appropriate to the site and watershed. I am not sure they are realistic in their timeline for getting a research permit from NOAA Fisheries, but they can apparently use Entrix, Inc. which is currently permitted.

## 4. Local Involvement.

The Sonoma Ecology Center is itself a nonprofit institution which conducts research and restoration projects. They are active in their outreach to the Sonoma Valley community and have a history of ensuring sufficient community involvement. The proposal pledges 14 workshops/meeting specific to the project as well as 2 written communications with the

## Bay Regional Review

community. They have already established a local partnership that will endure beyond the scope of this grant that includes citizens, County organizations and the CDFG. Their permission to access list shows representation from community groups and agricultural operations.

### 5. Local Value.

Yes. The Purpose Of The Project Is To Show If Restoration Actions Such As Those Taken In The Sonoma Creek Watershed (I.e. Habitat Enhancements And Migratory Barrier Removals) Have A Positive Effect On Salmonid Population. The Sonoma Ecology Center Proposes To Use PIT Tagging Of Steelhead Juveniles To Quantify Production To The Smolt Stage. A Fish Counting Device With A Digital Camera Will Also Be Installed In The Watershed To Document The Size Of Steelhead And Chinook Runs In The Creek. Physical Water Quality Parameters And Flow Will Be Recorded. If Success Can Be Quantified, It Will Provide Further Evidence That These Types Of Restoration Projects Are Needed And Are Successful In Recovering Listed Salmonids. This Is Applicable In All Their ESUs. They Should Also Prove Helpful In Recovering California Freshwater Shrimp. There Are Numerous Habitat Enhancement Projects Similar To Those In The Watershed Already In Place In California And Many More In The Planning Stages Or Seeking Funding.

### 6. Other Comments:

Sonoma Creek Is One Of The Most Valuable Streams We Still Have Salmonid Production In Within The San Francisco Bay. This Information Could Prove Extremely Valuable To NOAA Fisheries Efforts In Recovering Listed Salmonids And Would Be Used In Our Recovery Planning Processes. There Is A Similar Project Underway On Freshwater Creek In Humboldt County Which This Project Could Nicely Complement.

# External Technical Review #1

## Goals And Justification

Yes - habitat structures and migration barrier removal. Yes - objectives to increase shelter and habitat complexity, improve substrate and increase pool depth at site scale and increase usable habitat at a reach scale; and removing barrier. Although not explicitly stated, goal is to increase salmonid production. The conceptual model appears clear and includes underlying basis for restoration - ie changing channel morphology and instream aquatic habitat. The steelhead life cycle conceptual model shows how these factors would affect steelhead production. Yes - hypotheses are 1) either summer or winter habitat for age 1+ steelhead limits number of outmigrating age 2+ steelhead; 2) restoration helps improve summer and winter rearing habitat for age 1+ steelhead; and 3) removal of migration barriers provides access to habitat capable of producing age 2+ smolts. The hypotheses appear justified based on the information presented. Presumably the upcoming Limiting Factors Analysis will quantify the amount of habitat for each life stage (ie spawning, age 0, 1+ and 2+) to confirm that age 1+ is the limiting life stage). The work in this proposal should be revised as appropriate if the Limiting Factors Analysis shows that another life stage is limiting.

## Approach

In general, the approach appears well-designed and appropriate to meet the project's objectives. However, I did have the following questions/suggestions to improve the design of the approach to better meet the project's objectives: 1) I would suggest that the topographic cross-section monitoring be expanded to also include measurements of velocities, substrate, cover, and development of stage-discharge relationships for each cross-section. This would enable the amount of habitat at different flows to be quantified with PHABSIM. This would also require the use of habitat suitability criteria for each life stage - such criteria are available in the literature for steelhead and chinook salmon.

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2) Does the habitat monitoring method come up with a quantified habitat value (ie square feet of habitat), which could be correlated with abundance? Also, the reference (Flosi et al 1998) is missing from the literature cited section. 3) Could you get false positives on PIT tag loss by getting ad clipped fish from elsewhere (ie Feather River hatchery fish with CWTs)? 4) Will the PIT tag antennae cover the entire width of the stream and is the stream shallow enough at the antennae location so that any fish passing will be within two feet of the antennae? 5) Will the spring resurvey of fish be done with multiple-pass electrofishing with block nets? 6) There should be a backup plan in case the Vaki system doesn't work - the investigators should talk with people who have been using the Vaki system on the Yuba and Stanislaus Rivers to get ideas about how to make the Vaki system work better/more reliably. 7) Is there any calibration of the Vaki system planned for upstream migrants (ie using an upstream migrant trap)? I think there should be. 8) Can the Vaki system distinguish between male and female adult steelhead? This is necessary to know the number of spawning females. 9) Redd counts might be a better estimate of the number of spawning females than returning adult numbers - I would advise that the investigators talk to Sean Gallagher of CDFG [707-964-1492] - he had been doing similar work monitoring steelhead upstream migrants, redds, rearing juvenile densities and outmigrant numbers in the Noyo River. 10) Are there resident rainbow trout in the Sonoma Creek system? This could confound attempts to relate numbers of different life stages of steelhead. 11) Do PIT tags last long enough that they could be detected in returning adults? This would require a future monitoring program beyond that in the proposal, but would quantify the contribution of production in the Sonoma Creek system to returning populations, and look at things like straying rates, degree of semelparity, etc). The project adequately builds on previous monitoring, with the important modification of looking at spatial scales greater than site-level and to quantify the effects of habitat restoration on total production. With some modification, the monitoring and evaluation activities will make significant contributions to our knowledge-base. Specifically, if the monitoring can quantify the relative benefits of different restoration

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measures (ie pool depth versus instream cover) for steelhead production, they would be useful in designing more effective restoration projects. These contributions would be useful to decision-makers in deciding which restoration projects would likely be more effective in producing steelhead.

### Technical Feasibility

In general the project is fully documented. Exceptions include what would constitute a passable rating for barrier removal and how the relative effectiveness of different habitat improvement characteristics (ie depth versus cover) for steelhead production would be evaluated - I would suggest that a correlation approach would be a good addition to the planned treatment-control statistical analyses. The project appears technically feasible, with the possible exception of the Vaki system - having a backup plan for this study component will be important. The scale of the project is consistent with the objectives.

### Performance Measures

Yes, the data collected will allow evaluation of the restoration actions. Specific performance measures are proposed. The rationale for the performance measures is clearly demonstrated, with the possible exception of using only age 2+ migrants - it would be good to have a composite of age 0, age 1+ and age 2+ migrants, with the numbers from each age weighted by their assumed survival to return as adults. The proposed measures should allow for evaluation of the conceptual model of the restoration actions, by separating out effects at different portions of the conceptual model. The plan appears explicit and detailed enough to assess the performance of the restoration actions.

### Products

Yes, the project will lead to information that will be useful to resource managers and other scientists. The project explicitly states how others will be able to access the data from this project. Data handling, storage and dissemination

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measures appear adequate. The project should be able to produce high-quality results that are likely to stand up under peer review.

### **Capabilities**

The project team's qualifications are adequate and the mix of disciplines is appropriate to the project. The project team's performance record indicates that they have the ability to complete the project.

### **Budget**

The budget appears reasonable and adequate for the work proposed.

### **Additional Comments**

I would suggest the proposal be re-evaluated for technical merits after it has been revised.

# External Technical Review #2

## Goals And Justification

The proposal clearly identifies the restoration actions that are to be evaluated, and puts the evaluation in the broader context of restoration of the Sonoma Creek watershed, and of restoration of steelhead in the Bay-Delta and Central Valley. Specific goals and objectives are clearly stated, and are consistent with the overall aim of the project. The conceptual model is well thought out, complete, and clearly presented. The addition of the steelhead life history figure is helpful, although the authors would do well to obtain a graphic that prints more clearly for future proposals - Figure 3 was very fuzzy in the online-printed version of the proposal). The hypotheses to be tested are clearly identified, and will fill important knowledge gaps regarding watershed restoration in general, and steelhead recovery in particular.

## Approach

The approach chosen is well-designed and appropriate. Previous monitoring data are available, and care has been taken to eliminate redundancies in the experimental design and field protocols. The monitoring and evaluation activities are likely to make substantial contributions to the knowledge base. These activities will clarify whether barrier removal and instream habitat restoration to enhance habitat complexity and pools leads to an increase in the proportion of steelhead that smolt as larger age 2+, rather than smaller 1+ (and thus an anticipated increase in ocean survival rates). Furthermore, the proposal examines smolt production from both restored and unrestored reaches, to allow treatment vs. control comparisons. The proposal also examines steelhead restoration at the watershed scale, by determining the abundance of outmigrant smolts produced relative to returning spawners. This allows the project to better distinguish changes in abundance due to watershed effects or due to ocean-scale effects. This is a key aspect of the proposal, and one that is overlooked surprisingly often. Its inclusion here greatly

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strengthens the proposal, and indicates a clear understanding of anadromous fish population dynamics on the part of the proponents. The results of this project will give decision-makers a better understanding of how local restoration projects may be expected to contribute to watershed-scale restoration in general, and to steelhead recovery in particular.

### Technical Feasibility

The project is fully documented and technically feasible. I would have liked to see some more information on the expected peak flows, maximum widths and depths of the creeks that will have PIT antenna arrays. The photos shown of the PIT arrays suggest that the arrays can provide detection coverage for a water depth of about 3 feet. (in my experience PIT antennas for 12 mm PIT tags have an effective detection range of about 8", rather than the 2-3' mentioned in the proposal, given vagaries in fish orientation and flow dynamics near the antennas). Will flows tend to overtop the antennas to the point that fish passing by near the surface would be missed? Will flows be so high as to wash away the antennas, and will this happen at a time when a large proportion of tagged fish might be outmigrating? Will the antenna frameworks have a "breakaway" mechanism that will allow the antenna to lay on the bottom of the creek, or swing up and away in very high flows?

The scale of the project is consistent with the objectives. In the case of potential technical challenges such as mentioned above, the project is well-contained enough that I would expect these difficulties would be manageable without large cost overruns, or substantial data loss. I think the risks are outweighed by the potential gains in important knowledge about the Sonoma Creek system.

### Performance Measures

The data to be collected will allow evaluation of the prior restoration actions. Performance measures for each task are clearly described and justified, and include both habitat- and



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fish-based metrics. The data collected and subsequent analyses will provide reasonable feedback to re-assess and fine-tune the conceptual models. The monitoring and evaluation plan should allow an assessment of the restoration actions. Importantly, the proponents are aware of some of the limits of their field data to distinguish between local watershed effects, and more broad, regional and/or ocean scale effects, and have made efforts to control for these limitations. I would make one addition to these efforts, described below, but realize that it is beyond the scope of the current funding request.

The proponents note on page 5 of the proposal that it is important to distinguish between 1+ smolts, and 1+ downstream migrants that rear in the estuary and enter the ocean at age 2+. From my reading of the proposal it appears that the most downstream site at which steelhead will be detected is the counting weir/Vaki RiverWatcher fish counting device (plus digital camera and PIT antenna array) on the mainstem of Sonoma Creek at Leveroni Road Bridge. This will allow the researchers to distinguish whether steelhead moving downstream past the the PIT arrays at the tributary mouths are staying in the watershed. It appears that the proponents assume that fish passing downstream from Leveroni Road Bridge are headed for the ocean as 1+ smolts. However, it may be possible that steelhead that move downstream past the Leveroni Road Bridge may rear in the San Francisco Bay Estuary or move back upstream into other bay tributaries, then enter the ocean at age 2+. If these outmigrants do indeed continue to reside in freshwater for another year, an increase in spawners returning to Sonoma Creek may be caused by restoration actions taking place in these other tributaries, or in the San Francisco Bay estuary, rather than improvements within Sonoma Creek, or in the ocean. I would suggest that the proponents seek additional funding to analyze otoliths of deceased steelhead spawners (preferably recaptures of PIT tagged fish) to determine the proportion of spawners that entered the ocean at age 1+ versus 2+. This would allow the researchers to test whether any of the PIT tagged 1+ steelhead that passed Leveroni Road Bridge were actually 2+ by the time they entered the ocean. While collection of these fish carcasses would be labor intensive,

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and otolith analysis is relatively expensive, landowners may be willing to assist in the collection effort, and the otoliths could be stored until funds were available for analysis.

### Products

This project will produce information that will be valuable to managers, decision makers, and scientists, as well as residents of the Sonoma Creek watershed. The proponents have clearly described how information will be disseminated to these stakeholders, via its website, via online databases, presentations for the general public, in presentations to CalFed, in a final project report, and in the peer-reviewed literature. The project should produce results that would stand up to peer review.

### Capabilities

The project team appears to be well qualified to complete the project, and the mix of disciplines is adequate and appropriate. It is often the case that it is hard for people to find time to get project information into the peer-reviewed literature, particularly at the end of a project, when funding is ending and new projects are being developed. From the qualifications as described in the proposal, this team lacks a member with a particularly strong record of writing for the peer-reviewed literature. However, in conjunction with the consultants, and if adequate time is budgeted at the end of the project, this team may be able to accomplish the aim of peer-reviewed results.

### Budget

I consider this budget to be reasonable, while still being adequate for the work proposed. The SEC has the advantage of being locally based, which has greatly contained travel costs and per diem costs. The use of sub-contracting to consultants is reasonable, and is used appropriately. Through training by consultants in early stages of the project, SEC staff will gain skills and knowledge that will build their capacity to

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work unassisted on this and future watershed projects.

**Additional Comments**

I consider this to be an excellent proposal, well worthy of full funding.

# External Technical Review #3

## Goals And Justification

This proposal clearly identifies the multiple restoration projects, funded by CALFED and other agencies that have been completed over the past six years and will be monitored as part of this well written and interesting proposal. The proposal provides a clear and strong statement of the goals and objectives of the monitoring at the population and watershed scale. Although it suggests Sonoma Creek is an "excellent laboratory" for other Bay-Delta watersheds (presumably because of its locality), it does not expand on this. A conceptual model linking life-history diversity with reach-scale physical monitoring is well-developed, but the construction of a "population model" (as suggested in the Goals and Objectives and Conceptual Model sections) is not adequately described based on the results of all the monitoring proposed. Figures 2 & 3 accurately describe the linkages and limiting factors. The hypotheses are directly stated in the Conceptual Model section and seem well justified based on the results of limiting factor analysis, however the investigators suggest they are focused on "developing the species-specific conceptual model" then developing hypotheses to address watershed inputs, geomorphic inputs, and habitat characteristics. There appears a bit of inconsistency in the goals and objectives related to hypothesis-testing and model building, and the quantitative population model is not well described in the proposal. Nowhere in the Expected Outcome and Products sections does it include the steelhead population model, a specified Goal, as a result of this work.

## Approach

The experimental design should permit for evaluation of the hypotheses proposed. The results from the various monitoring efforts could allow for a quantitative population model based on limited demographic information. However, the investigators do not clearly state the linkage between their monitoring and the population model they plan to develop. The performance

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measures are indirectly linked to the population model, although they clearly reflect a focused effort to link fish populations and physical changes occurring as a result of restoration activity. The project builds upon the monitoring efforts already underway by the investigators. Depending on the type of population model completed as part of this proposal, not all demographic variable may be determined for all stages in a steelhead stage-based or age-based model. It is nice to see so much previous monitoring has been completed and provides a tremendous baseline for the physical inputs investigators might develop into the population models. I think winter spawner surveys may be necessary to determine the different number of redds in the untreated vs. treated reaches, and thus an estimate of the number of potential age 0+ fish. There have been some difficulties with the VAKI RiverWatcher system the investigators hope to utilize, however it is likely the best alternative of the potential efforts that can be made to effectively characterize the adult population. Proposed physical monitoring of reaches is adequate for post-spawning characterization of spawning gravel quality and mobility, oversummering habitat, temperature, and overwintering habitat. If the relationships between population model and conceptual model were more clearly proposed and the monitoring and evaluation activities completed, restorationists may gain insight into the effects of restoration on the population biology of a steelhead population and learn new information about what age or life history stage is most sensitive to different restoration actions.

### Technical Feasibility

This proposal is fully documented and technically feasible. The project is consistent with the reach and watershed monitoring efforts, but lacks details about building the steelhead population model. As noted earlier, organizations using the Vaki RiverWatcher system have experienced mixed results as a result of the complexities of this system. Although proposers are certain that a Section 10 Permit is forthcoming, NOAA-Fisheries has limited these over the past four years. Fortunately, the proposed handling of fish and

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leading of fieldwork by Entrix, under contract, would seem to support the work being completed during the grant period, regardless of permitting status. It is also nice to know that SEC has worked extensively and subcontracted with Entrix and other consulting firms previously. It is possible that SEC and Stillwater employees handling fish will additionally need a CDFG Scientific Collectors Permit.

## Performance Measures

The data collected will allow for a solid evaluation of the restoration activities that are being monitored. The proposed performance measures clearly reflect the substantial effort put into developing the conceptual model that incorporates life history variation, physical limiting factors, and other existing knowledge. The performance measures seem logical after reading the conceptual model. The resulting data collected by the proposed monitoring and evaluation will provide information to adapt the conceptual model to accurately reflect the linkages between restoration activities and steelhead life histories. Because of the experimental design, differences may be detectable among similar restoration techniques utilized or completed in distinct fashions, which may yield very interesting information about the performance of restoration actions. The plan is not explicit or detailed enough in assessing the linkage between monitoring of restoration activities and developing a population viability model to evaluate sensitivities of steelhead to a range of management measures, although it is likely that it may support preliminary development of a steelhead population model for Sonoma Creek. There is no supported statement that the performance measures used for evaluation of habitat restoration in Sonoma Creek is transefferrable to other Bay-Delta watersheds as suggested by the investigators, although it may be true that they are indicative of Bay Delta watershed with similar limiting factors.

## Products

The project will provide important analyses and potentially rewarding conclusions for managers and scientists to consider when developing instream, reach-scale restoration projects. Data handling, storage, and dissemination are adequate for open access and shared use of the project's results. These data will be included in multiple web-based databases in standardized models and attributes to enable full integration by other interested parties. The proposal should produce some high-quality results that should be publishable in the peer-reviewed literature. Neither the lead investigator or SEC staff have published in the peer-reviewed literature recently, although Stillwater Science staff appear to pursue publication of data from visiting their website.

## Capabilities

The project team's qualifications are considerable and permit for successful completion of the project. Members of the team include geologists, hydrologists, ecologists, a population modeler, and analysts. The proposers' performance records indicate they have the technical ability, community relationships, and field experience to complete the project.

## Budget

The budget is almost half Service and Consultants, and in fact consultants will be taking more of the budget than the lead investigator's organization. It is unfortunate with such a long-term staff with advanced degrees that the SEC is not making an effort to hire a scientist who can lead them in the well- designed monitoring protocols or do more of the monitoring, writing, and work they are giving to consultants in house. This would be the only way I could see for the costs to possibly be less. So, the proposal seems to heavily rely on subcontracting since SEC investigators will be relying on Stillwater for substantial oversight of monitoring at the reach- and watershed- level, and continued guidance. However, given the division of tasks as proposed and the permitting issues, the budget seems reasonable and potentially more than

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adequate given the amount of consulting in the proposal.

### **Additional Comments**

Although there seems to be some inconsistencies with regards to the population modelling, this is a very strong proposal and one that will result in informative results. With a little reworking on the Approach to explicitly link the model with the performance measures, it would be clearly and thoroughly developed enough to permit hypothesis testing.



# External Technical Review #4

## Goals And Justification

The proposal will monitor restoration projects within Sonoma Creek watershed, including pool enhancement sites and a barrier removal site.

The goals and objectives are to assess the performance of prior restorations by comparing steelhead smolt 'production' from unaltered pools to production from restored pools, specifically regarding the production of age 1+ or older steelhead smolts, and also to document production from a stream reach upstream of a former barrier.

The basis is that many agencies and organizations are conducting habitat restoration but the success of these restorations is not ordinarily evaluated.

Three hypotheses are stated: age 1+ habitat limits steelhead smolt production; restoration provides more age 1+ habitat; migration barriers limit age 1+ habitat.

The hypothesis that age 1+ habitat is limited is possible because larger juveniles need deeper pools, larger interstices, and larger food items. If limiting factors are truly identified it could greatly improve chances for successful steelhead restoration in Sonoma Creek and maybe even elsewhere. The hypothesis that restoration improves age 1+ habitat is a major assumption of restoration programs and certainly needs to be verified. The hypothesis that instream barriers reduce production by eliminating usable habitat for age 1+ steelhead is intuitive and not necessarily in need of being tested although evaluation of the results of barrier removal is potentially useful.

## Approach

The proposal suggests it will provide experimental evidence for restoration method effectiveness but the approach is not

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experimental. An experimental approach would be to select sites for restoration work and similar control sites where no work will be conducted. Then, monitor habitat conditions and fish populations at all sites for an adequate period for comparison after restoration is completed, say at least 3 years to get an estimate of interannual variation. Next, complete the restoration projects and continue to monitor both restoration and control sites. In this approach the control site monitoring acts as a measure of environmental variation that can be contrasted with data from the treatment site to see if changes at restored sites can be distinguished from overall environmental variation.

The proposed study is simply a statistical comparison between sites that have already been restored and sites that haven't. This is a much less rigorous approach that will be confounded by site differences and environmental variation. The proposal assumes that steelhead populations of 'control' sites will be distinguishable as a group from a group of restored sites. In truth, there is bound to be much variation among both control and restored sites and it is likely this variation will make statistical comparisons difficult. It is also likely that both control reaches and restored reaches will vary in the amount and quality of age 1+ habitat they provide. It is even possible that some control reaches will provide more or higher quality habitat than some restoration reaches.

The proposal is aimed at evaluating the success of restoration projects but begins by assuming that these projects are successful. This sounds more like a verification study than an assessment. A true test of the limiting age 1+ habitat hypothesis would at minimum evaluate all reaches individually regardless of whether they have been restored or not and document specifically how each study reach varies and what features are common to reaches that have high age 1+ smolt production. It is only useful to group reaches together if they are similar in a measurable way. Subjective groupings have no scientific meaning and confound statistical analyses.

The proposal makes frequent reference to former studies but provides only subjective information from those studies, so it

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is difficult to determine whether the proposal is based on objective or subjective results. Based on the amount of activity in the basin, evaluation of success is definitely justified but it is unclear how hard data from former studies have been incorporated into this study, except for the known presence of restoration sites and a population estimate of steelhead in the basin.

Potential contributions to the knowledge base are: 1. documentation of juvenile steelhead use of 28 reaches in the Sonoma Creek basin, 14 unrestored and 14 restored; 2. documentation of juvenile steelhead movement; 3. comparison of steelhead 'production' from restored versus unrestored pools; 4. comparison of steelhead retention and survival within restored versus unrestored pools; 5. documentation of emigration versus immigration rates; 6. before and after habitat conditions at restoration sites; 7. comparison of 'physical habitat parameters' between restoration and control reaches based on the SEC modified CDFG protocol; 8. all above contributions may be related to stream discharge or water temperature patterns.

The most significant contribution would likely be detailed documentation of emigration versus immigration rates. This will provide valuable baseline data on steelhead population dynamics for the Sonoma Creek basin. However, the link between watershed scale populations and river restoration is tenuous at best. Many, many factors can influence the spawning female to smolt ratio within the Sonoma Creek basin and unless a very large percentage of steelhead production within the basin occurs at the three restoration sites or above the two removed barriers, changes at the site level will be swamped by trends that affect the entire basin. Also, there are no comparable pre-restoration data.

Baseline data on emigration and immigration rates and movements of juvenile steelhead in Sonoma Creek basin would be useful for future decision makers provided they also have new data to compare with the baseline. However, providing baseline data is not the primary objective of the proposal.

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Whether comparative data of steelhead movements from and retention in restored versus unrestored reaches will be useful for decision makers is anybody's guess. It relies entirely on the assumption that control reaches as a group are significantly different from restored reaches as a group. Significantly different in this context means that steelhead production is affected in a measurable way. If a difference is detected it will be of limited use for decision makers unless the much more important question of why there is a difference is also answered. Will it be clear that specific features associated with restoration increased steelhead production? This is important because installation of similar structure elsewhere will not result in the same success unless they have the same improving effect.

Why is it important to understand the mechanistic link between habitat restoration and increased age 1+ steelhead growth and retention? There are an infinite number of examples but here is one: perhaps the limiting factor for juvenile steelhead in Sonoma Creek basin is embedded substrate due to silt, as suggested in the proposal. It is possible then that habitat restoration could improve conditions for steelhead by facilitating scour that flushes interstices and removes surface sediments. Where does the flushed sediment go? In most cases it proceeds to the next downstream bar. Thus, if restoration was successful in this way, it might improve conditions for steelhead in one location, but degrade them in another. The net effect may be no improvement or worse even though success is documented at the specific restoration site. However, if we have learned that silt is the limiting factor for steelhead production, we can then focus directly on reducing silt loads through riparian and upland improvements to reduce erosion and instream improvements to trap and store sediment in the floodplain and allow a natural silt free channel to develop.

### **Technical Feasibility**

The key to understanding the effects of restoration on fish production relies on habitat. How does the restoration affect habitat? Then, how does the change in habitat affect fish

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production? This study must be able to objectively and convincingly demonstrate the link between physical habitat restoration and steelhead habitat use if the results are to be applied elsewhere. Otherwise, even if a response is observed, the mechanism remains a mystery.

It is possible that data from a previously funded geomorphological assessment will allow a comparison of physical habitat between control and restored reaches, but this is not clear in the proposal. As written, the proposal evaluates steelhead production response directly from fish abundance without the link to habitat so the study may be able to demonstrate a difference in production between habitats, but will not explain how or why.

Because of the importance of understanding links between habitat and steelhead, the habitat portion of the proposal should provide more detail. Why aren't topographic surveys proposed for control reaches? What is the specific value and use of the SEC adapted CDFG protocol (the proposal references a paper by Flosi et al. 1998 but the reference is absent from the literature cited). Are all of these habitat measures subjective? Have the SEC adaptations been proven to be valid? If so, how specifically have they improved the CDFG protocol? Most importantly, will this habitat information be sufficient to provide a functional understanding of how habitat restoration works to improve steelhead production or will this habitat information be used in conjunction with steelhead population data to simply fuel speculation?

The proposed work on Asbury Creek is more than is necessary to meet the objective of determining whether reaches upstream of the former barrier will support age 1+ steelhead. All that is necessary is surveys upstream of the former barrier. The need for sampling sites below the former barrier is unclear. Also, visual surveys may be less intensive and less intrusive than electrofishing surveys. Alternatively, trapping fishes emigrating from the reach above the former barrier may be more informative by documenting 'production', not just presence.

If the study objective is to assess the success of restoration

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sites and barrier removal then the watershed scale study is not necessary. If the reach scale study is able to document differences between 'control' reaches and restored reaches in a manner that convincingly shows that habitat improvements are responsible, then no additional evidence will make the results more convincing. However, the watershed scale study does have potential to contradict the reach scale study if one study shows an increase in steelhead production but the other shows no increase or a decline.

### Performance Measures

Evaluation of the restoration actions is not certain. It will not be determined whether habitat is limiting for age 1+ steelhead. It may be shown that restored reaches are more productive but the cause will remain unknown. Evaluation of steelhead use of Asbury Creek upstream of the former barrier will be more conclusive. Either age 1+ steelhead will be present or not.

Performance measures for habitat are: 1. there will be net habitat changes at restoration sites; 2. restored reaches will have better habitat ratings than control reaches; 3. fish can pass where the barrier used to be.

The habitat performance measures clarify the weakness of the link between habitat and steelhead production in this proposal. What does a net change in habitat at a restoration site signify? Why aren't control sites also evaluated for habitat change? What if habitat conditions at control sites also change for the better but it is not quantified? Does a change in the habitat parameters that will be measured at restoration sites necessarily indicate improvement? Do subjective habitat ratings truly reflect the needs of steelhead? Does the passability of the former barrier site imply that habitat upstream is suitable to produce age 2+ smolts?

Performance measures for fish monitoring are: 1. comparison of annual abundance of age 1+ and older steelhead in restored versus unrestored reaches; 2. comparison of the number of

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smolts from restored versus unrestored reaches; 3. overwinter survival of juvenile steelhead in restored versus unrestored reaches.

The rationale for these measures relies on the expectation that restored reaches will support higher steelhead abundance and that steelhead abundance is the best measure of restoration success. The rationale suggests that the size of smolts is very important for success at sea, but steelhead size will not be compared between control and restored reaches.

Performance measures for watershed level monitoring are: 1. smolt to spawning female ratios; 2. returning adult to 'outmigrant' ratios; 3. increased outmigrant age, size, or both; 4. decreasing summer water temperature.

It is expected that habitat restoration will lead to more smolts and outmigrants compared to spawning females and returning adults, increased age and size of outmigrants, and reduced summer water temperatures. It is not clear how documentation of these trends would be specifically linked to habitat restoration and separated from other environmental variation such as weather or year class variation among spawners.

As written, the proposal is not explicit or detailed enough to truly differentiate the affects of habitat restoration from other effects. A huge amount of data collection is proposed and would certainly produce new information, particularly with regard to steelhead population dynamics in the Sonoma Creek basin, but will not directly demonstrate links between habitat restoration and steelhead production. The proposal is based on correlation and coincidence not cause and effect.

## Products

The large amount of data on steelhead abundance, movement, immigration, and emigration will definitely be useful for comparison with any previous data and with future data. Topographical surveys of restoration sites will also be useful for comparison with previous and future surveys. Usefulness

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of steelhead abundance comparisons between restoration and control sites will depend on how effectively steelhead response can be linked to specific habitat improvements, if a response is indeed detected.

Data from this study would be readily accessible in many useful forms.

Data handling and storage will be adequate.

The focus of the proposed peer-reviewed article is not specifically stated. Because the proposal relies on being able to detect a difference in abundance between control and restored reaches, the ability to publish results may rely on whether such a difference is detected or not. In either case, it would be most publishable if abundance comparisons were interpretable in relation to quantifiable habitat features, not subjective features.

### Capabilities

The project team has many decades of combined experience in all relevant fields for this study. The level of education also appears to be adequate although graduate research experience is less directly related to this specific proposal. The performance record is more difficult to judge. Only one team member is listed as publishing in peer reviewed literature.

### Budget

The budget seems reasonable and adequate for the work proposed, although it is a large amount, being nearly half that spent to date on the Sonoma Creek basin restoration. Given this amount of money, it would be worth the time to focus the project more specifically on determining the link(s) between juvenile steelhead production and habitat rather than simply documenting trends in steelhead populations. Based on the objectives, much more work is proposed than is necessary. To determine relative steelhead production between restored and nonrestored sites would only require the reach based study



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and PIT tag monitoring. To determine whether steelhead spawn and rear upstream of the former barrier would only require either surveys in those reaches or trapping at the site of the former barrier. The other proposed work has potential value but is more suited for other objectives than those listed. If the study is focused specifically on the objectives as stated, it would be much less expensive.

#### **Additional Comments**

The potential importance of estuary reared steelhead is noted in the proposal but is not part of the study. If estuaries are better producers of age 2+ smolts, perhaps estuary restoration is more important than stream habitat restoration. Is work being done to also study estuary production and the interaction between the estuary and the basin?

# Budget Review

1. Does the proposal include a detailed budget for each year of the requested support?

**Yes.**

2. Does the proposal include a detailed budget for each task identified?

**Yes.**

3. Are project management expenses appropriately budgeted?

**Yes.**

4. Does the proposal clearly state the type of expenses encompassed in indirect rates or overhead costs? Are indirect rates, if used, appropriately applied?

**Yes.**

5. Does the budget justification adequately explain major expenses? Are the labor rates and other charges proposed reasonable in relation to current state rates?

**Yes.**

If no, please explain:

**Labor rates appear to be reasonable. An evaluation of classification level for tasks is recommended. Major equipment line item (\$90,000).**

**Major Expenses -If the grant is awarded a detailed list of equipment purchases should be provided by the grantee so reviewers can better evaluate whether it is more cost effective for the state to purchase large dollar equipment items through the state procurement process. If the equipment list is available within the State inventory or stock, then purchase of some or all of the listed items may be provided, loaned, or leased by the state to the grantee. In the event, that the equipment is purchased by the grantee, the grantee shall maintain an inventory of major equipment for auditing purposes and potential use for future projects. Grantee shall follow State Contracting Manual [SCM] Section 7.61 thru 7.62 rules pertinent to equipment purchase, lease, etc.**

6. Are other agencies contributing or likely to contribute a share of the projects costs?

**Yes.**

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## Budget Review

If yes, when sufficient information is available, please sum the amount of matching funds likely to be provided:

**Cost share partners (total: \$100,000). Potential cost share partners (total: \$492,400).**

**Cost Sharing-** Recommend that Grantee provide information regarding its financial capability and stability as well as its level of commitment for any proposed cost share funds. A detailed budget of the project's proposed cost share funds should be provided prior to grant funds being awarded. A financial evaluation is recommended for grant agreements that state/claim over 30 % or \$250,000 (which ever is less) of matching funds. The evaluation will avoid likelihood of the grantee requesting an amendment to increase project funding due to lack of or miscalculation of matching funds to complete the project.

7. Does the applicant take exception to the standard grant agreement's terms and conditions? If yes, are the approaches the applicant proposes to address these issues a reasonable starting point for negotiating a grant agreement?

**Yes.**

8. Are there other budget issues that warrant consideration?

**Yes.**

If yes, please explain:

**Task and Deliverables-** More detailed information is needed for task and deliverables including subcontractor work for each specific task, services, and work to be performed with the appropriate and corresponding deliverable or end product for each task(s) and/or sub-task(s). Costs associated with each task and deliverable should be evaluated based on what is considered to be reasonable costs for performing similar services.

Other comments:

**Proposals for work to be performed by subcontractors or other**

## Budget Review

entities in excess of the 25% of the total project dollars the grantee is required to provide a justification for subcontracting services. If subcontractors are pre-selected and identified in the proposals as part of the project team, the grantee should provide a justification on how each subcontractor was selected. Grantee shall identify labor rates and indirect costs rates paid to each identified subcontractor to ensure that labor rates are comparable to State rates.

The Subcontracted work should be identified with a rate and hours and attributed to each task and deliverable for each year. A performance evaluation is also recommended for subcontractors that receive more than 50% of the grant funds. If the subcontractor has not been identified, a position description complete with education level, experience, and abilities be submitted and the rate and hour associated with that position will be attributed to a task, and deliverable. The grantee must also comply with the State competitive bidding process as stated in the PSP.

# Environmental Compliance Review

1. Is compliance with California Environmental Quality Act (CEQA) required for this project?

**No.**

2. Is compliance with National Environmental Policy Act (NEPA) required for this project?

**Yes.**

3. Does this project qualify for an Exemption or Exclusion under CEQA and NEPA, respectively?

**Yes.**

Comments

**Item 2 above is checked "yes" because there is a potential federal cost share partner. The Lawrence Berkeley National Laboratory (LBNL) is contributing funds to this project. LBNL is operated by UC Berkeley for the U.S. Department of Energy.**

4. Did the applicant correctly identify if CEQA/NEPA compliance was required?

**No.**

Comments

**Consultation with NOAA Fisheries will be necessary to confirm if NEPA is required due to the potential federal funding source.**

5. Did the applicant correctly identify the correct CEQA/NEPA document required for the project?

**No.**

Comments:

**Applicant not aware of potential need for a NEPA document.**

6. Has the CEQA/NEPA document been completed?

**No.**

## Environmental Compliance Review

7. If the document has not been completed, did the applicant allot enough time to complete the document before the project start date?

**Yes.**

8. If the document has not been completed, did the applicant allot enough funds to complete it?

**Yes.**

9. Did the applicant adequately identify other legal or regulatory compliance issues (Incidental Take permits, Scientific Collecting permits, etc.) that may affect the project?

**No.**

Comments:

**The applicant will need a Scientific Collecting Permit from the State. The proposal did not indicate that the permit would be required or had been obtained.**

10. Does the proposal include written permission from the owners of any private property on which project activities are proposed or, if specific locations for project activities are not yet determined, is it likely that permission for access can be obtained?

**Yes.**

Comments:

**Permission has been obtained by local and state agencies and local landowners to access property. Copies of the permission letters are not included in the proposal.**

11. Do any of these issues affect the project's feasibility due to significant deficiencies in planning and/or budgeting for legal and regulatory compliance or access to property?

**No.**

Comments:

**The applicant allotted 1 year to obtain a section 10 permit which is already in progress. A State Scientific Collecting permit may take approximately 12 weeks to obtain, so the project should not be delayed due to the permit processing time. If a NEPA Categorical Exclusion is needed, it should be obtainable in the time allotted for the Section 10 permit.**

# Prior-Phase Funding Review #1

List the other CALFED or CVPIA grants received by this applicant for which your agency manages contracts:

<b>Project Title</b>	Arundo Eradication and Coordination Program Phase 2
<b>CALFED Contract Management Agency</b>	GCAP
<b>Amount Funded</b>	\$1,840,791
<b>Date Awarded</b>	2004/01/01
<b>Project Number</b>	not assigned yet--in contracting

3. Have negotiations about contracts or contract amendments with this organization proceeded smoothly, without persistent difficulties related to standard contract terms and conditions?

**Yes.**

4. Are the status, progress, and accomplishments of the organization's current CALFED or CVPIA project(s) accurately stated in the proposal?

**N/A**

5. Has this organization made adequate progress towards these project(s)' milestones and outcomes, without unreasonable divergences from project schedules or poor-quality deliverables?

**N/A**

6. Is the applicant's reporting, record keeping, and financial management of these projects satisfactory?

**N/A**

7. If this application is for a next phase of a project whose contract your agency currently manages, will the project(s) be ready for next-phase funding to monitor and evaluate project outcomes in fiscal year 2005/6, based on its current progress and expenditure rates?

**N/A**

Other comments:

**GCAP is finalizing the SOW and Budget for award of the current**

Prior-Phase Funding Review #1

project #151DA. The Recipient Agreement for this project is anticipated to have an end date of December 2007.



## Prior-Phase Funding Review #2

List the other CALFED or CVPIA grants received by this applicant for which your agency manages contracts:

<b>Project Title</b>	CALFED ERP 2000-E04
<b>CALFED Contract Management Agency</b>	National Fish and Wildlife Foundation
<b>Amount Funded</b>	\$438,923
<b>Date Awarded</b>	2000/01/01
<b>Project Number</b>	E04
<b>Project Title</b>	CALFED ERP 2001-N27
<b>CALFED Contract Management Agency</b>	National Fish and Wildlife Foundation
<b>Amount Funded</b>	\$545,170
<b>Date Awarded</b>	2001/01/01
<b>Project Number</b>	N-27

3. Have negotiations about contracts or contract amendments with this organization proceeded smoothly, without persistent difficulties related to standard contract terms and conditions?

**N/A**

**We do not have a contract with SEC directly; they are a co-sponsor with Southern Sonoma RCD.**

4. Are the status, progress, and accomplishments of the organization's current CALFED or CVPIA project(s) accurately stated in the proposal?

**Yes.**

5. Has this organization made adequate progress towards these project(s)' milestones and outcomes, without unreasonable divergences from project schedules or poor-quality deliverables?

**N/A**

**We do not have a contract with SEC directly; they are a co-sponsor with Southern Sonoma RCD.**

6. Is the applicant's reporting, record keeping, and financial management of these projects satisfactory?

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Prior-Phase Funding Review #2

**Yes.**

7. If this application is for a next phase of a project whose contract your agency currently manages, will the project(s) be ready for next-phase funding to monitor and evaluate project outcomes in fiscal year 2005/6, based on its current progress and expenditure rates?

**Yes.**

Other comments:

SEC installed some large woody debris in Calabazas Creek for a pool enhancement study under the previously funded CALFED project #01-N27. After this work began, there was a miscommunication between SEC and the landowner regarding acquiring landowner permission for the work to begin. This situation was quickly resolved as SEC stopped work and acquired the written permission from the landowner immediately. Site work was then completed in November 2003. SEC has taken measures to ensure this situation will not be repeated and has continued to work closely with the landowner and other stakeholders to preserve a good working relationship with them.