Battle Creek Salmon and Steelhead Restoration Project

Project Information

1. **Proposal Title:**

   Battle Creek Salmon and Steelhead Restoration Project

2. **Proposal applicants:**

   David Gore, US Bureau of Reclamation

3. **Corresponding Contact Person:**

   David Gore
   U.S. Bureau of Reclamation
   2800 Cottage Way Sacramento, CA 95825-1898
   916 978-5308
   dgore@mp.usbr.gov

4. **Project Keywords:**

   Fish Passage/Fish Screens
   Fish, Anadromous
   Habitat Restoration, Instream

5. **Type of project:**

   Implementation_Full

6. **Does the project involve land acquisition, either in fee or through a conservation easement?**

   No

7. **Topic Area**:

   Fish Passage

8. **Type of applicant:**

   Federal Agency

9. **Location - GIS coordinates:**

Latitude:	40.435
Longitude:	-121.870
Datum:	NAD 83

   Describe project location using information such as water bodies, river miles, road intersections, landmarks, and size in acres.

This restoration project is located in the Battle Creek Watershed. Battle Creek, located northeast of Red Bluff, CA, is tributary to the Sacramento River at Sacramento River Mile 271.5. The community of Manton lies between the two main forks of Battle Creek.

10. **Location - Ecozone:**

    4.4 Battle Creek

11. **Location - County:**

    Shasta, Tehama

12. **Location - City:**

    Does your project fall within a city jurisdiction?

    No

13. **Location - Tribal Lands:**

    Does your project fall on or adjacent to tribal lands?

    No

14. **Location - Congressional District:**

    CA 3rd District, Honorable Doug Ose

15. **Location:**

    California State Senate District Number: 4

    California Assembly District Number: 2

16. **How many years of funding are you requesting?**

    3

17. **Requested Funds:**
    a) Are your overhead rates different depending on whether funds are state or federal?

       No

       If no, list single overhead rate and total requested funds:

       Single Overhead Rate: 130

       Total Requested Funds: 12,000,000

    b) Do you have cost share partners already identified?

Yes

If yes, list partners and amount contributed by each:

Pacific Gas & Electric Company in-kind services

c) Do you have potential cost share partners?

No

d) Are you specifically seeking non-federal cost share funds through this solicitation?

No

If the total non-federal cost share funds requested above does not match the total state funds requested in 17a, please explain the difference:

18. **Is this proposal for next-phase funding of an ongoing project funded by CALFED?**

Yes

If yes, identify project number(s), title(s) and CALFED program (e.g., ERP, Watershed, WUE, Drinking Water):

1999-B01 Battle Creek Salmon and Steelhead Restoration Project ERP

Have you previously received funding from CALFED for other projects not listed above?

No

19. **Is this proposal for next-phase funding of an ongoing project funded by CVPIA?**

No

Have you previously received funding from CVPIA for other projects not listed above?

Yes

If yes, identify project number(s), title(s) and CVPIA program.

8-07-20-W1528	**Battle Creek Interim Flow Agreement**	**Water Acquisition Program Section 3406b3**

20. **Is this proposal for next-phase funding of an ongoing project funded by an entity other than CALFED or CVPIA?**

    No

    Please list suggested reviewers for your proposal. (optional)

21. **Comments:**

Environmental Compliance Checklist

Battle Creek Salmon and Steelhead Restoration Project

1. **CEQA or NEPA Compliance**
   a) Will this project require compliance with CEQA?

      Yes
   b) Will this project require compliance with NEPA?

      Yes
   c) If neither CEQA or NEPA compliance is required, please explain why compliance is not required for the actions in this proposal.

2. **If the project will require CEQA and/or NEPA compliance, identify the lead agency(ies).** *If not applicable, put "None".*

   CEQA Lead Agency: State Water Resources control Board
   NEPA Lead Agency (or co-lead:) U.S. Bureau of Reclamation
   NEPA Co-Lead Agency (if applicable):

3. **Please check which type of CEQA/NEPA documentation is anticipated.**

   CEQA
   -Categorical Exemption
   -Negative Declaration or Mitigated Negative Declaration
   XEIR
   -none

   NEPA
   -Categorical Exclusion
   -Environmental Assessment/FONSI
   XEIS
   -none

   If you anticipate relying on either the Categorical Exemption or Categorical Exclusion for this project, please specifically identify the exemption and/or exclusion that you believe covers this project.

4. **CEQA/NEPA Process**
   a) Is the CEQA/NEPA process complete?

      No

      If the CEQA/NEPA process is not complete, please describe the dates for completing draft and/or final CEQA/NEPA documents.

      Draft EIS/EIR: Late November 2001 Final EIS/EIR: Late April 2002

   b) If the CEQA/NEPA document has been completed, please list document name(s):

5. **Environmental Permitting and Approvals** (*If a permit is not required, leave both Required? and Obtained? check boxes blank.*)

LOCAL PERMITS AND APPROVALS

Conditional use permit	
Variance	
Subdivision Map Act	
Grading Permit	
General Plan Amendment	
Specific Plan Approval	
Rezone	
Williamson Act Contract Cancellation	
Other	Required

STATE PERMITS AND APPROVALS

Scientific Collecting Permit	
CESA Compliance: 2081	
CESA Compliance: NCCP	
1601/03	Required
CWA 401 certification	Required
Coastal Development Permit	
Reclamation Board Approval	
Notification of DPC or BCDC	
Other	Required

FEDERAL PERMITS AND APPROVALS

ESA Compliance Section 7 Consultation	Required
ESA Compliance Section 10 Permit	
Rivers and Harbors Act	
CWA 404	Required
Other	Required

PERMISSION TO ACCESS PROPERTY

Permission to access city, county or other local agency land.
Agency Name:

Permission to access state land.
Agency Name:

Permission to access federal land.
Agency Name:

Permission to access private land.
Landowner Name:

6. **Comments.**

All applicable Shasta and Tehama County permits shall be complied with. These permits include County road Encroachment Permits, Fugitive Emission/Dust Permits and Hazardous Materials permits. The National Historic Preservation Act will also be complied with.

Land Use Checklist

Battle Creek Salmon and Steelhead Restoration Project

1. **Does the project involve land acquisition, either in fee or through a conservation easement?**

   No

2. **Will the applicant require access across public or private property that the applicant does not own to accomplish the activities in the proposal?**

   Yes

3. **Do the actions in the proposal involve physical changes in the land use?**

   Yes

   If you answered yes to #3, please answer the following questions:

   a) How many acres of land will be subject to a land use change under the proposal?

      approximately 10

   b) Describe what changes will occur on the land involved in the proposal.

      The footprint of various physical features including fish screens and ladders, pipelines, access roads, and other physical structures will affect primariy grazing land or or streambed. Small acreages of wetlands and riparian zones will be effected by these footprints. Removal of canals and dams will return landuse in those footprint areas to native conditions.

   c) List current and proposed land use, zoning and general plan designations of the area subject to a land use change under the proposal.

Category	**Current**	**Proposed (if no change, specify "none")**
Land Use	**Grazing**	**Footprint of physical features related to propsed project.**
Zoning	**Agricultural**	**None**
General Plan Designation	**Open space**	**None**

   d) Is the land currently under a Williamson Act contract?

      No

   e) Is the land mapped as Prime Farmland, Farmland of Statewide Importance, Unique Farmland or Farmland of Local Importance under the California Department of Conservation's Farmland Mapping and Monitoring Program?

      No

f) **Describe what entity or organization will manage the property and provide operations and maintenance services.**

Pacific Gas & Electric Company will manage the property and provide operation and maintenance services.

4. **Comments.**

It is not anticipated that any additional land will be required to implement the propsed structural features of this proposal. Some additional permanent easements may need to be acquired from private landowners and other federal agencies (BLM) to accomodate the burial of structural pipe and other features of the project. In addition, temproary construction access may be required from some landowners to implement features. Discussions with these landowners is ongoing and problems are not anticipated in acquirng the necessary temporary construciton access. Nearly, all of the facilites lie on existing PG&E Company lands, our partner in this proposed project. PG&E Company currently holds various access rights from surroundiong landowners and these are being researhed as to their sufficiency for implementing this restoration project.

Conflict of Interest Checklist

Battle Creek Salmon and Steelhead Restoration Project

Please list below the full names and organizations of all individuals in the following categories:

- **Applicants listed in the proposal who wrote the proposal, will be performing the tasks listed in the proposal or who will benefit financially if the proposal is funded.**
- **Subcontractors listed in the proposal who will perform some tasks listed in the proposal and will benefit financially if the proposal is funded.**
- **Individuals not listed in the proposal who helped with proposal development, for example by reviewing drafts, or by providing critical suggestions or ideas contained within the proposal.**

The information provided on this form will be used to select appropriate and unbiased reviewers for your proposal.

Applicant(s):

David Gore, US Bureau of Reclamation

Subcontractor(s):

Are specific subcontractors identified in this proposal? No

Helped with proposal development:

Are there persons who helped with proposal development?

Yes

If yes, please list the name(s) and organization(s):

Jean Oscamou Pacific gas & Electric Company

Harry Rectenwald CA Dept. of Fish and Game

Comments:

PG&E Comapany and DFG helped in the development of this proposal in a review capacity. The proposal was also provided to Fish and Wildlife Service (Mr. Jim Smith, Mr. Matt Brown), and to the National Marine Fisheries Service (Mr. Mike Tucker)but no reivew comments were provided by these other agencies. Some of the material used in the preparation of this proposal was taken from the draft Adaptive Management Plan prepared for the Battle Creek Salmon and Steelhead Restoration Project by Mr. Mike Ward (Terraqua Environmental Consulting, subcontractor to Kier and Associates, subcontractor to Navigant Consultants.

Budget Summary

Battle Creek Salmon and Steelhead Restoration Project

Please provide a detailed budget for each year of requested funds, indicating on the form whether the indirect costs are based on the Federal overhead rate, State overhead rate, or are independent of fund source.

Federal Funds

Year 1												
Task No.	Task Description	Direct Labor Hours	Salary *(per year)*	Benefits *(per year)*	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Management	3875	96870	15980	20000	3000	0	0	0	135850.0	109950	245800.00
2	Construction						1521900			1521900.0		1521900.00
		3875	96870.00	15980.00	20000.00	3000.00	1521900.00	0.00	0.00	1657750.00	109950.00	1767700.00

Year 2												
Task No.	Task Description	Direct Labor Hours	Salary *(per year)*	Benefits *(per year)*	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Management	6002	150036	24758	20000	3000	0	0	0	197794.0	170306	368100.00
2	Construction	0	0	0	0	0	6129550	0	0	6129550.0	0	6129550.00
		6002	150036.00	24758.00	20000.00	3000.00	6129550.00	0.00	0.00	6327344.00	170306.00	6497650.00

Year 3												
Task No.	Task Description	Direct Labor Hours	Salary *(per year)*	Benefits *(per year)*	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Management	6315	157875	26049	20000	3000	0	0	0	206924.0	179176	386100.00
2	Construction	0	0	0	0	0	3348550	0	0	3348550.0	0	3348550.00
		6315	157875.00	26049.00	20000.00	3000.00	3348550.00	0.00	0.00	3555474.00	179176.00	3734650.00

Grand Total=12000000.00

Comments.

Budget Justification

Battle Creek Salmon and Steelhead Restoration Project

Direct Labor Hours. Provide estimated hours proposed for each individual.

Labor hours fall under three categories (Project Management included separately below: Inspection: Estimated 8080 hours over 3 year period for inspection associated with construction of physical features. Contract Administration: Estimated 3212 hours over three year period associated with contract administration duties including validation of costs, processing amendments and change orders, report preparation, and other duties. Engineering Support: Estimated 300 hours over three year period associated with engineering review of any propsed modfiications to the designs which arise during construction.

Salary. Provide estimated rate of compensation proposed for each individual.

An average base salary of $25 per hour was assumed for all disciplines. Actual rates of individuals will vary based on duties and time in service.

Benefits. Provide the overall benefit rate applicable to each category of employee proposed in the project.

Benefits are based on a standard 16.5% for all categories. The charges represent the Government's share or contribution of the cost for employees' health benefits, FICA/Medicare, Civil Service Retirement System, or the Federal Employyees Retirement System.

Travel. Provide purpose and estimate costs for all non-local travel.

Inspectors within the Bureau of Reclaamtion are based in Willows California. Travel expenses are based on paying per diem rates for inspectors who live outside the general commute range of the proposed project. This is estimated at approximately $20,000 per year for a total of $60,000.

Supplies & Expendables. Indicate separately the amounts proposed for office, laboratory, computing, and field supplies.

Office Supplies: $1000 per year = $3000 Field Supplies: $2000 per year = $6000

Services or Consultants. Identify the specific tasks for which these services would be used. Estimate amount of time required and the hourly or daily rate.

Services consist of two items: 1. Construction contracts associated with implementation of the physical features of the project: The proposed project is anticipated to be constructed through a series of four contracts. Requested funding is not detailed by specification to prevent revealing cost information to any potential bidders that may participate in the procurement process. 2. Forgone Power Costs: Under terms of teh Battle Creek Salmon and Steelhead Restoration Project Memorandum of Understanding June 1999 the government is required to pay Pacific Gas & Electric Company a total sum of $2,137,100 for costs associated with loss of energy generation during construction ($54,400) and the estimated value of forgone energy resulting from this project over the life of the current FERC license ($2,082,700).

Equipment. Identify non-expendable personal property having a useful life of more than one (1) year and an acquisition cost of more than $5,000 per unit. If fabrication of equipment is proposed, list parts and materials required for each, and show costs separately from the other items.

None

Project Management. Describe the specific costs associated with insuring accomplishment of a specific project, such as inspection of work in progress, validation of costs, report preparation, giving presentatons, reponse to project specific questions and necessary costs directly associated with specific project oversight.

Project Management Costs represent, for purposes of this presentation, costs associated with the Project construciton Engineer associated with this project and their lead Field Engineer and Office Engineer. An estimated 4600 hours are projected for Project Management actvities over the three year period associated with this proposal.

Other Direct Costs. Provide any other direct costs not already covered.

None

Indirect Costs. Explain what is encompassed in the overhead rate (indirect costs). Overhead should include costs associated with general office requirements such as rent, phones, furniture, general office staff, etc., generally distributed by a predetermined percentage (or surcharge) of specific costs.

Leave Additive = 25% A percentage applied to salaries and wages to cover the cost of paid time off of all employees. As emplyees work, the surcharge is charged to the same account their regular time is charged and credited to the Leave Account, K90. When employees take time off, their time is then charged to K90 and paid with the credits that were accumulated from the surcharge. Regional Indirect Costs (RIC) = 30% Every office, both Regional and Area offices, in the Mid-Pacific region will be assessed. These costs cover operational expenses and services that serve all clients in the whole Mid-Pacific Region. Office Indirect Costs (OIC)= 59% for the Mid-Pacific Construciton Office. Leaves charges distribute local operational and service charges that serve all clients.

Executive Summary

Battle Creek Salmon and Steelhead Restoration Project

This 2002 Ecosystem Restoration PSP proposal seeks supplemental funding to complete implementation of flow and facility features for the proposed Battle Creek Salmon and Steelhead Restoration Project (Restoration Project), CALFED Project No. 1999-B01. The proposed action includes the removal of five small hydropower diversion dams, the construction of new fish screens and ladders on another three dams, and the construction of several hydropower facility modifications to ensure the continued hydropower operations. Battle Creek is a tributary of the Sacramento River located in northern California about 20 miles southeast of the city of Redding. It drains 356 square miles and is dominated by the volcanic slopes of Mount Lassen. The Proposed Project is located in the anadromous fish reaches of Battle Creek and its tributaries. Over the last several decades severe declines in anadromous fishery populations have been identified in the Sacramento-San Joaquin Bay Delta and upper Sacramento River watershed. In the Battle Creek watershed, anadromous fish species have been particularly affected by hydropower development. PG&E Company operates hydroelectric facilities in the Battle Creek watershed (Federal Energy Regulatory Commission (FERC) Project No. 1121). In the past, these facilities substantially altered the natural stream flow, thereby reducing the amount of available anadromous fishery habitat for spawning, holding, and rearing. Eleven specific objectives have been identified for this proposed restoration project classified into three categories: 11) Salmon and steelhead Populations; 2) Habitat; and 3) Passage. A conceptual model is identified and hypotheses are defined for each objective. The proposed project incorporates a multifaceted adaptive management approach that uses the best available science to develop a comprehensive solution. This proposed project meets many of the ERP visions for Central valley streamflows, stream meanders, natural floodplains and flood processes, sediment supply, stream temperatures, riparian and riverine aquatic habitats, endangered species.

Proposal

US Bureau of Reclamation

Battle Creek Salmon and Steelhead Restoration Project

David Gore, US Bureau of Reclamation

Battle Creek Salmon and Steelhead Restoration Project
CALFED Bay-Delta Program
2002 Ecosystem Restoration PSP Proposal
October 2001

A. Project Description: Project Goals and Scope of Work

Proposed Project: This 2002 Ecosystem Restoration PSP proposal seeks supplemental funding to complete implementation of flow and facility features for the proposed Battle Creek Salmon and Steelhead Restoration Project (Restoration Project), CALFED Project No. 1999-B01. The Restoration Project is subject to completion of environmental compliance and Federal Energy Regulatory Commission license amendment process requirements. Restoration Project alternatives consist of a "No Action" alternative and action alternatives. These alternatives are undergoing a National Environmental Policy Act/California Environmental Quality Act (NEPA/CEQA) analysis, which is being documented in an Environmental Impact Statement/Environmental Impact Report (EIS/EIR). Action alternatives consist of various combinations of dam decommissioning and removals, fish screen improvements, fish ladder improvements, and increased stream flow below dams. The proposed action stems from the Memorandum of understanding by and Among the National Marine Fisheries Service, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, California Department of Fish and Game and pacific Gas and Electric Company, dated June 1999 (MOU). The proposed action incorporates the following flow and facility features:

- Coleman Diversion Dam:
    - Install a tailrace connector from Inskip Powerhouse to Coleman Canal and a water bypass facility around Inskip Powerhouse to Coleman Canal
    - Decommission the dam and appurtenant facilities.
- Inskip Diversion Dam:
    - Install an approved Fish Screen.
    - Install an approved Fish Ladder.
    - Install a tailrace connector from South Powerhouse to Inskip Canal concurrent with, or prior to, the Inskip Diversion Dam fish screen.
- South Diversion Dam:
    - Decommission the dam, related water conveyance and appurtenant facilities.
- Wildcat Diversion Dam:
    - Decommission the dam, related water conveyance and appurtenant facilities.
- Eagle Canyon Diversion Dam:
    - Install an approved Fish Screen.
    - Install an approved Fish Ladder.
    - Decommission spring collection facilities
- North Battle Creek Feeder Diversion Dam:
    - Install an approved Fish Screen.
    - Install an approved Fish Ladder

- Soap Creek:
    - Decommission the dam, related water conveyance and appurtenant facilities.
- Lower Ripley Creek:
    - Decommission the dam, related water conveyance and appurtenant facilities.
- Baldwin Creek:
    - Provide a means for releasing a maximum instream flow of 5 cfs from Asbury Pump Diversion.
- Prescribed Instream Flow Releases
- Water Acquisition Fund
- Adaptive Management Plan
- Adaptive Management Fund
- Water rights dedication to the environment at all dam removals.

Two tasks are defined to accomplish proposal:

Task 1: Facility Construction
Task 2: Construction Management/Project Management

1. Problem –

Location
Battle Creek is a tributary of the Sacramento River (mouth is located at about Sacramento River Mile 272) located in northern California about 20 miles southeast of the city of Redding. Battle Creek forms the boundary between Shasta and Tehama Counties. It drains 356 square miles and is dominated by the volcanic slopes of Mount Lassen. The Proposed Project is located in the anadromous fish reaches of Battle Creek and its tributaries. Natural barriers to anadromous fish migration in the form of large waterfalls are located on both the North and South Forks at river miles 13.48 and 18.85 respectively. Figure 1 shows the key features of the Battle Creek watershed.

Problem
Over the last several decades severe declines in anadromous fishery populations have been identified in the Sacramento-San Joaquin Bay Delta and upper Sacramento River watershed. These declines have been variously attributed to water resource development, including the Bureau of Reclamation's (Reclamation) Central Valley Project, State water Project, hydropower development, irrigation district facilities, commercial and sport fishing, ocean conditions, and other factors. This has led to the listing, at various levels, of several anadromous species under both the Federal and State Endangered Species Acts. The endangered species status of the populations of spring-run chinook, winter-run chinook and steelhead is shown in Table 1. Outside of the Sacramento River, Battle Creek is all that remains of the historical range of this species and it is believed that remnants of the population still exist there.

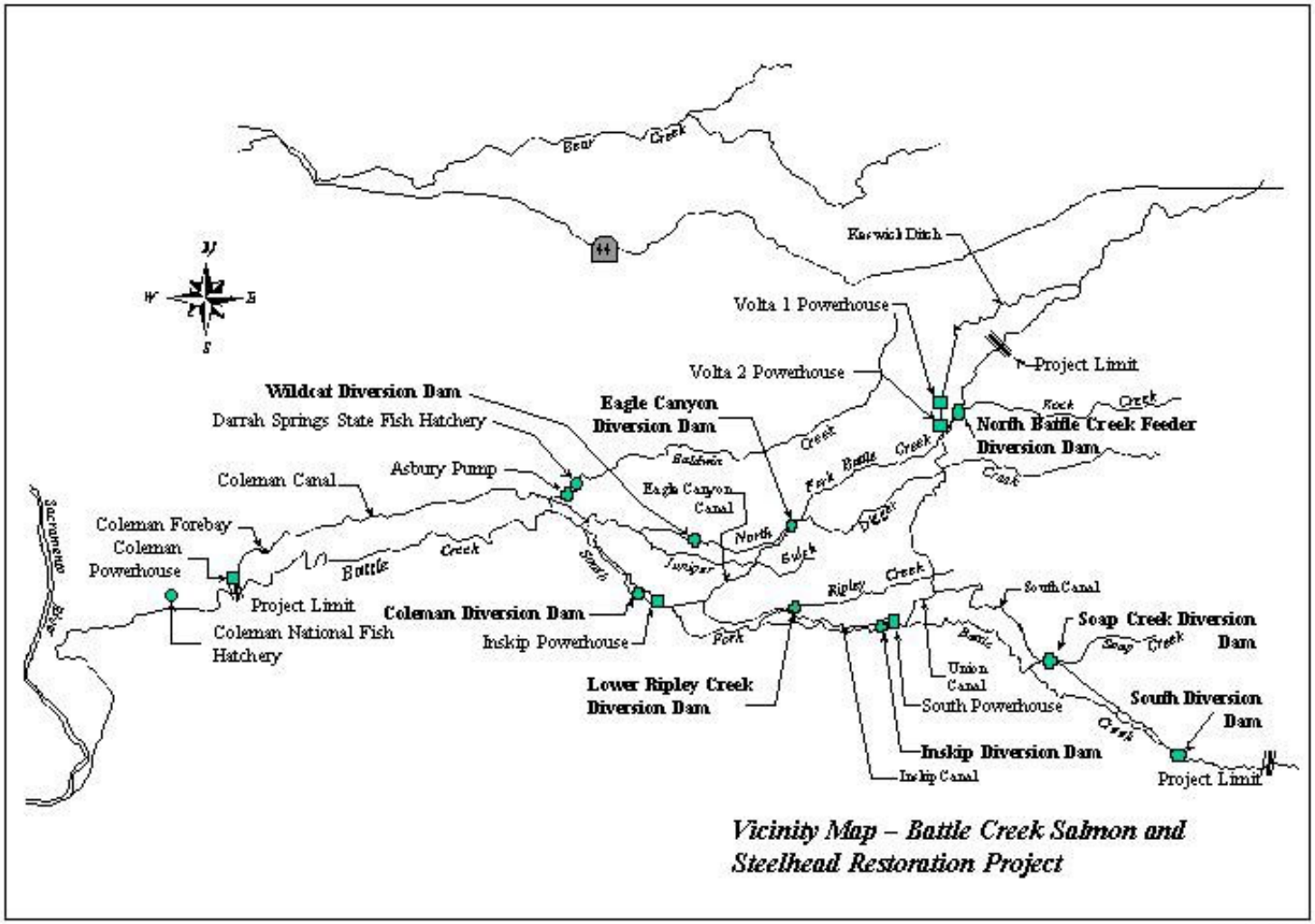

Bear Creek
44
Kerwick Ditch
Volta 1 Powerhouse
Project Limit
Volta 2 Powerhouse
Wildcat Diversion Dam
Darrah Springs State Fish Hatchery
Eagle Canyon Diversion Dam
North Battle Creek Feeder Diversion Dam
Rock Creek
Asbury Pump
Coleman Canal
Eagle Canyon Canal
Coleman Forebay
Coleman Powerhouse
Battle Creek
Project Limit
Coleman National Fish Hatchery
Coleman Diversion Dam
Inskip Powerhouse
Lower Ripley Creek Diversion Dam
South Canal
Soap Creek Diversion Dam
Union Canal
South Powerhouse
South Diversion Dam
Inskip Diversion Dam
Inskip Canal
Project Limit
Vicinity Map – Battle Creek Salmon and Steelhead Restoration Project

Figure 1

Table 1. Endangered Species Status of Battle Creek Anadromous Salmonid Populations

Species	Status	Effective Date of Listing
Chinook Salmon		
ESA– Sacramento River Winter Run	Endangered	2/3/94
CESA–Sacramento River Winter Run	Endangered	9/22/89
ESA– Central Valley Spring Run	Threatened	11/15/99
CESA– Sacramento River Spring Run	Threatened	2/5/99
ESA – Central Valley Fall and Late-Fall Run	Candidate	9/16/99
Steelhead		
ESA – Central California Coast	Threatened	10/17/97

In the Battle Creek watershed, anadromous fish species have been particularly affected by hydropower development. PG&E Company operates hydroelectric facilities in the Battle Creek watershed (Federal Energy Regulatory Commission (FERC) Project No. 1121). In the past, these facilities substantially altered the natural stream flow, thereby reducing the amount of available anadromous fishery habitat for spawning, holding, and rearing. Problems identified associated with the Battle Creek Hydroelectric Project are summarized in the following bullets:

- Insufficient instream flows below PG&E Company diversion dams limit fish production. Required minimum instream flows under the current FERC License are only 3 cubic feet per second at the North Fork Diversions and 5 cubic feet per second at the South Fork diversions. Under these FERC license flows the hydropower facilities remove up to 98 percent of the base natural stream flow.
- Current lack of ramping procedures below the diversion dams does not meet the intent of State and Federal endangered species laws.
- Current instream flows from the power diversions indirectly increase temperature to levels adverse to salmonid survival. This is particularly true in the South Fork.
- False attraction of anadromous salmonids from the North Fork to the South Fork leads to fish mortality, unstable population structure, and loss of production.
- Fish passage facilities at the dams do not assure safe passage of adult and juvenile salmonids. Existing fish ladders were designed and built many years ago and do not meet current standards. Also, hydropower project diversions are currently unscreened, potentially causing mortality to naturally spawned fish produced above the diversions.

Other resource areas not seen as limiting factors or key components in the fishery resource management problems in the Battle Creek ecosystem include gravel recruitment, riparian community structure, upland land use, channel geomorphology, channel maintenance flows, and others. Many of these factors are not considered limiting because hydrologic and hydraulic conditions in the watershed, even with the presence of the hydropower diversions, do not preclude the occurrence of flow levels that govern these physical processes.

Relevant Past Studies, Programs, Plans

Historically, Battle Creek is considered one of the most important chinook salmon-spawning streams of the Sacramento-San Joaquin basin. The creek, flowing through deep, shaded canyons and riparian corridors, and maintained by cold, spring-fed water even in drought years, exhibits qualities ideal for restoration of salmon and steelhead species. The fishery restoration potential of Battle Creek has been recognized and supported in the following acts, programs, and plans:

- Upper Sacramento River Fisheries and Riparian Habitat Management Plan (California Senate Bill 1086), 1989
- Central Valley Salmon and Steelhead Restoration and Enhancement Plan, California Department of Fish and Game, 1990
- California State Salmon, Steelhead Trout, and Anadromous Fisheries Program Act (California Senate Bill 2261), 1990
- Steelhead Restoration Plan and Management Plan for California, California Department of Fish and Game, 1990
- Central Valley Project Improvement Act Anadromous Fish Restoration Program (Title 34 of Public Law 102-5750, 1992
- CALFED California Bay-Delta Ecological Restoration Program
- Restoring Central Valley Streams – A Plan for Action, California Department of Fish and Game, 1993
- Actions to Restore Central Valley Spring-Run Chinook Salmon, California Department of Fish and Game, 1996
- National Marine Fisheries Service Proposed Recovery Plan for Sacramento River Winter-Run Chinook Salmon, National Marine Fisheries Service, 1997
- U.S. Fish and Wildlife Service Draft Central Valley Anadromous Fish Restoration Plan, 1997 (final in 2001)
- California Department of Fish and Game Status Review for Spring Run Chinook Salmon in the Sacramento River, 1998

Recognition of the fishery restoration potential of Battle Creek led to the development of a "Battle Creek Salmon and Steelhead Restoration Plan – January 1999." This plan lays out a scientific framework for restoring Battle Creek to meet anadromous fish needs.

Purpose, Goals, Objectives

The purpose of the Restoration Project is to restore and enhance approximately 42 miles of habitat in the mainstem and two primary forks of Battle Creek downstream of the naturally impassible waterfalls and in about 6 miles of its tributaries, while minimizing the loss of clean and renewable energy produced by the Battle Creek Hydroelectric Project.

General goals and objectives associated with the Restoration Project Proposed Action include:

- Restoration of self-sustaining populations of chinook salmon and steelhead and of their habitat in the Battle Creek watershed through a voluntary partnership with state and federal agencies, a third-party donor, and PG&E Company.
- Up-front certainty regarding specific restoration components, including Resource Agency-recommended in-stream flow releases, selected removal or decommissioning of dams at key locations in the watershed, dedication of water diversion rights for in-stream purposes at decommissioned sites, construction of tailrace connectors, and installation of state-of-the-art fish screens and fish ladders meeting contemporary state and federal criteria.

Eleven specific objectives are identified pertaining to salmon and steelhead populations, habitat, and passage. These eleven objectives are:

- Salmon and Steelhead Populations
    - Ensure successful salmon and steelhead spawning and juvenile production.
    - Restore and recover the assemblage of anadromous salmonids (i.e., winter-run, spring-run, steelhead) that inhabit the stream's cooler reaches during the dry season
    - Restore and recover the assemblage of anadromous salmonids (i.e., fall-run, late-fall-run) that enter the stream as adults in the wet season and spawn upon arrival
    - Ensure salmon and steelhead fully utilize available habitat in a manner that benefits all life stages thereby maximizing natural production and full utilization of ecosystem carrying capacity
- Salmon and Steelhead Habitat Objectives
    - Maximize usable habitat quantity – increase streamflow
    - Maximize usable habitat quantity – water temperature-release cold water springs to creek
    - Minimize false attraction under current conditions where transbasin diversion of North Fork water to South Fork that is part of the hydroelectric project allows flow mixing
    - Minimize harmful fluctuation in thermal and flow regimes due to planned outages or detectable leaks from the hydroelectric project
    - Minimize stranding or isolation of salmon and steelhead due to variations in flow regimes caused by hydroelectric project operations
- Salmon and Steelhead Passage Objectives
    - Provide reliable upstream passage of salmon and steelhead adults at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams per contemporary engineering criteria and/or standards/guidelines
    - Provide reliable downstream passage of juveniles at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams per contemporary criteria after the transfer of facilities to Licensee
    - Provide reliable upstream passage of adult salmon and steelhead to their appropriate habitat over natural obstacles within the Restoration Project area while maintaining an appropriate level of spatial separation among the runs

The restoration in Battle Creek of anadromous fish populations also plays a part in meeting the broader goals of the Central Valley Project Improvement Act (CVPIA). This Act mandated the development of a program that makes all reasonable efforts to increase the natural production of anadromous fish to levels not less than twice the average level attained during the period of 1967-1991. Finally, many of the goals and objectives of the CALFED Ecosystem Restoration Program (ERP) are addressed in the Restoration Project. Strategic goals identified in the "Ecosystem Restoration Program Draft Stage 1 Implementation Plan – August 2001" which apply to the proposed Restoration Project include 1) Goal 1 – At-Risk Species; 2) Goal 2 – Ecosystem Processes and Biotic Communities; and 3) Goal 4 – Habitats. Restoration priorities for the Sacramento Region identified in the Draft Stage 1 Implementation Plan which apply to the Restoration Project include: 1) Develop and implement habitat management and restoration actions in collaboration with local groups; 2) Restore fish habitat and fish passage particularly for spring-run chinook salmon and steelhead trout and conduct passage studies; 3) Conduct adaptive management experiments in regard to natural and modified flow regimes to promote ecosystem functions of otherwise support restoration actions; and 4) Develop conceptual models to support restoration of river, stream, and riparian habitat.

Hypotheses

Specific hypotheses identified for the Restoration Project Proposed Action are listed in Table 2 below. These hypotheses are related to the specific objectives identified above.

2. Justification -

The overarching conceptual model employed in Battle Creek was the development of a classification system that anticipated the maximum potential restored fish habitat by stream reach and species. Each stream reach within the project-affected portion of the Battle Creek watershed was categorized by professional judgment using a system of five grades depending on a suite of attributes including potentially restorable temperature regime, cold water accretions from springs, physical habitat characteristics, species life history, length of stream reach, stream gradient, reach elevation, and past observations in similar watersheds. Figures 1 through 3 depict fishery habitat ecosystem attributes in Battle Creek for spring and winter-run chinook salmon and steelhead. Table 3 further delineates the model by defining specific ecosystem attributes to the descending grades of quality of habitat depicted in Figures 1 through 3. This overarching conceptual model was supported by the use of reference streams (e.g., Mill and Deer Creeks, Little Sacramento and McCloud Rivers) and the importance of abundant coldwater spring resources.

This conceptual model was then strengthened by the use of more specific, biological models of key stream reach attributes such as instream flow and potentially usable fish habitat, spawning gravel surveys, water temperature, natural fish passage barriers, and fish passage at diversion dams. Instream flow and available fish habitat was modeled

using the instream flow incremental methodology (IFIM), performed by TRPA (1998a), which described the relationship between instream flow and the quantity of fish habitat in each reach of the project-affected area for several fish species and lifestages. This instream flow model was interpreted using an limiting life stage model that assessed the relative importance of habitat for three life stages of chinook salmon, including fry, juvenile, and spawning, through the use of a mathematical model that determined, for each reach, which type of habitat limited production under varying flow regimes. Water temperatures, under possible alternative solutions to the management problem, were modeled using the SNTEMP model (Tu 2001; TRPA 1998c, 1998d) to insure that thermal regimes would approximate those found in other streams supporting spring-run chinook. Natural fish passage barriers were analyzed by field measurements and the use of a model, the application of which helped determine at what flow a potential barrier would become impassable to migrating chinook and steelhead. Natural fish barriers are modeled on stream hydraulics (water velocity, direction, turbulence), geometry (height of barrier, pool depth, passage routes), and composition (bedrock, boulders) (Surveys of Barriers to the Upstream Migration of Anadromous Salmonids – Battle Creek Fisheries Studies June 10, 1998). Fish passage at diversion dams was considered in light of state and federal standards for fish ladders and criteria for fish screens established to maximize the effectiveness of these types of facilities for salmon and steelhead. Furthermore, the cost of fish passage facility modification was compared with diversion dam decommissioning. Finally, economic models of power production were used to estimate economic impacts of various restoration efforts.

The formulation and proposed implementation of the Restoration Project has, and is, following a passive adaptive management process. The passive adaptive management process has been adopted based upon comments received from the CALFED Independent Science Program (Healy 2001) on the draft Adaptive Management Plan that has been prepared for the Restoration Project. The six steps of passive adaptive management adopted for the proposed Restoration Project (Healy 2001) are shown in Table 3.

An extended discussion of how the six steps of the passive adaptive management process has been implemented is found in the "Draft Battle Creek Salmon and Steelhead Restoration Project Adaptive Management Plan – March 2001 (as revised September 2001)."

The proposed project is a full-scale restoration project implementation based upon scientific understanding. A high degree of scientific certainty that justifies moving forward with full-scale implementation stems from two directions. First, exhaustive documentation was completed in association with the Battle Creek Salmon and Steelhead restoration Plan (Ward and Kier 1999). In the development of this Plan extensive assessments of hydrology, geology, fish populations, selected stream dependent plants and animals, hydroelectric power generation operations, and operations of the Coleman National Fish Hatchery were made. In addition, the Restoration Plan assessed Sacramento River fisheries management and environmental factors and considered past restoration efforts and contemporary restoration efforts. The Restoration Plan fully developed goals, objectives, and models in the context of Battle Creek ecosystem

Table 2. Restoration Project Hypotheses

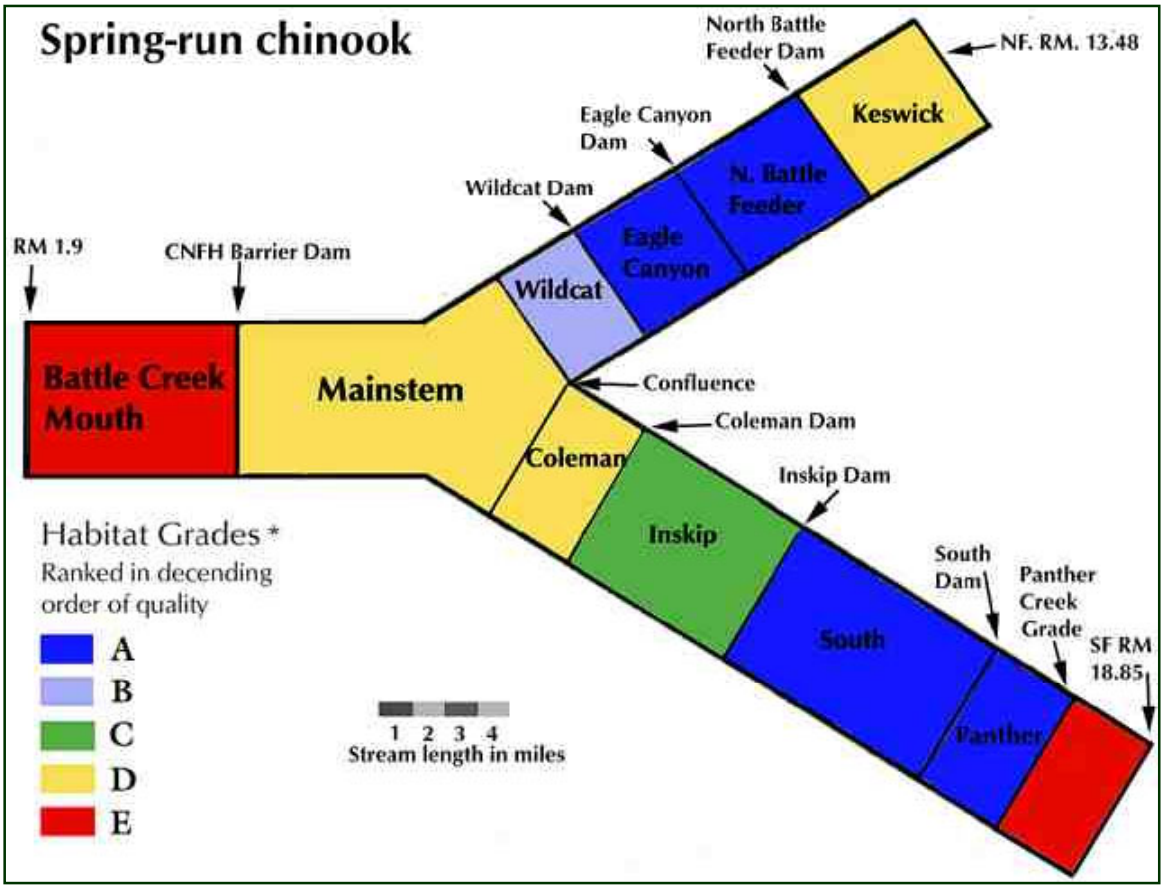
POPULATION OBJECTIVE 1
Ensure successful salmon and steelhead spawning and juvenile production.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that juvenile salmon and steelhead production is within the expected range given the number of spawning adults and relevant ecological factors.
POPULATION OBJECTIVE 2
Restore and recover the assemblage of anadromous salmonids (i.e., winter-run, spring-run, steelhead) that inhabit the stream's cooler reaches during the dry season
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that populations of spring-run, winter-run and steelhead are at Viable Population Levels.
POPULATION OBJECTIVE 3
Restore and recover the assemblage of anadromous salmonids (i.e., fall-run, late-fall-run) that enter the stream as adults in the wet season and spawn upon arrival.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that populations of fall-run and late-fall-run are at Viable Population Levels.
POPULATION OBJECTIVE 4
Ensure salmon and steelhead fully utilize available habitat in a manner that benefits all life stages, thereby maximizing natural production and full utilization of ecosystem carrying capacity.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that, once populations of anadromous salmonids are at Viable Population Levels, the natural production of populations of anadromous salmonids within the Restoration Project Area is maximized based on full utilization of habitat and ecosystem carrying capacity.
HABITAT OBJECTIVE 1
Maximize usable habitat quantity – volume.
HYPOTHESIS: Implementation of instream flow levels specified in the description of the Restoration Project, and implementation of any adaptive responses affecting instream flows, will provide at least 95% of maximum usable habitat quantity for critical life stages among priority species.
HABITAT OBJECTIVE 2
Maximize usable habitat quantity – water temperature.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will provide instream water temperatures that are suitable for critical life stages among species at appropriate stream reaches.
HABITAT OBJECTIVE 3
Minimize false attraction and harmful fluctuation in thermal and flow regimes due to planned outages or detectable leaks from the hydroelectric project.
HYPOTHESIS: Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that water discharges from the powerhouse tailrace connectors or water conveyance system are confined to times and amounts that avoid false attraction, or biologically significant changes to thermal and chemical regimes. [1]
HABITAT OBJECTIVE 4
Implementation of facilities modifications specified in the description of the Restoration Project,

[1] "Chemical" in this sense refers to chemical constituents of stream water at detectable levels that may be used by migrating salmonids for homing or spawning area recognition.

Table 2. Restoration Project Hypotheses (cont.)

implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will minimize stranding or isolation of salmon and steelhead due to variations in flow regimes caused by hydroelectric project operations.
HYPOTHESIS: Variation in flow regimes, following forced or scheduled outages where the available diversion flow has been released to the natural stream channel, do not strand salmon and steelhead or isolate them from their habitat when diversions are resumed.
PASSAGE OBJECTIVE 1
Provide reliable upstream passage of salmon and steelhead adults at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams per contemporary engineering criteria and/or standards/guidelines.
HYPOTHESIS: Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will insure unimpeded passage of Adult salmon and steelhead at fish ladders relative to contemporary criteria and/or standards/guidelines.
PASSAGE OBJECTIVE 2
Provide reliable downstream passage of juveniles at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams per contemporary criteria after the transfer of facilities to Licensee.
HYPOTHESIS: Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that hydraulic parameters at fish screens meet contemporary criteria at all times.
PASSAGE OBJECTIVE 3
Provide reliable upstream passage of adult salmon and steelhead to their appropriate habitat over natural obstacles within the Restoration Project area while maintaining an appropriate level of spatial separation among the runs.
HYPOTHESIS Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that Natural instream barriers do not impede upstream migration of adult salmon and steelhead at prescribed flows and normal wet season flow regimes.

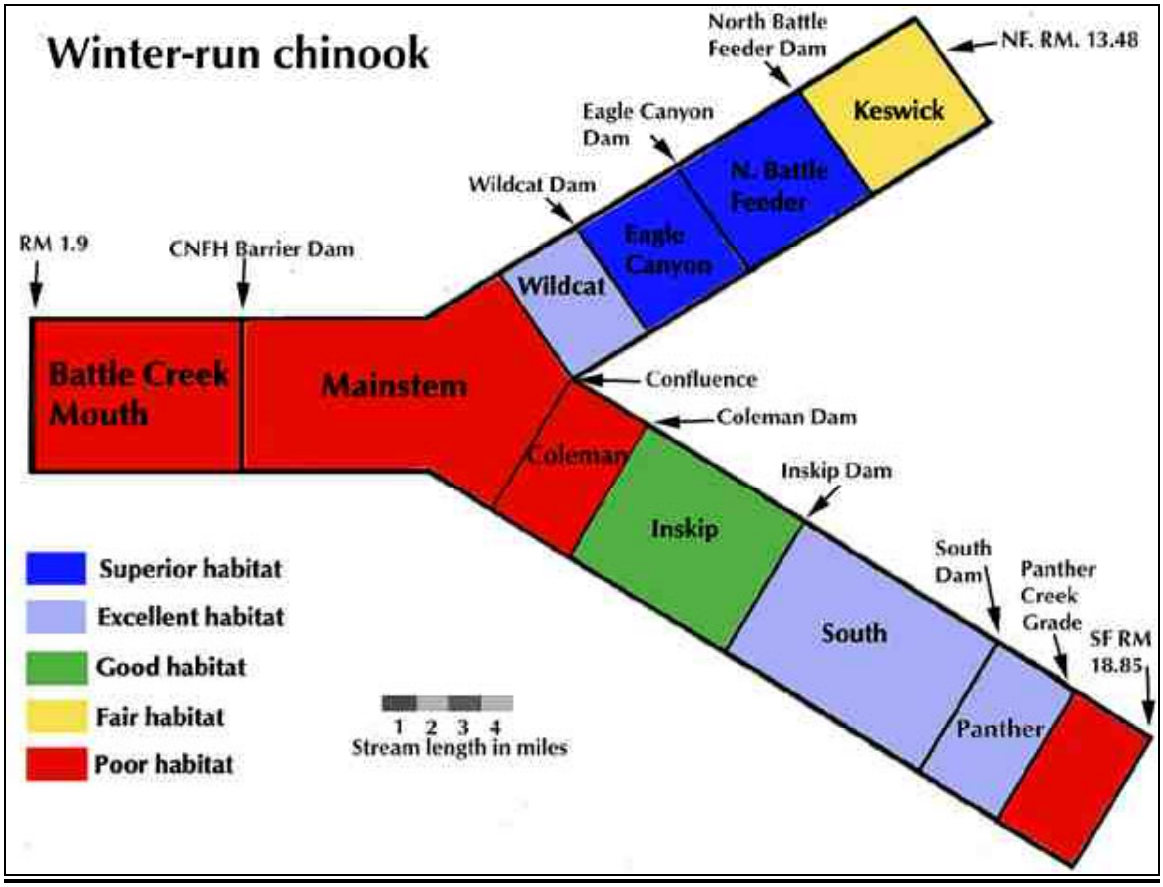
Figure 1. Spring-Run Chinook Salmon Habitat Conceptual Model



Habitat in the Wildcat Reach would be reduced to "C grade" if instream flow releases were insufficient to maintain water temperatures for winter-run chinook incubation at levels that avoid chronic problems.

Habitat prioritization was determined by professional judgment based on restorable temperature regime, cold water accretions from springs, physical habitat characteristics, species life history, length of stream reach, stream gradient, and past observations in similar watersheds. For a more descriptive summary of habitat grades see Table 3.

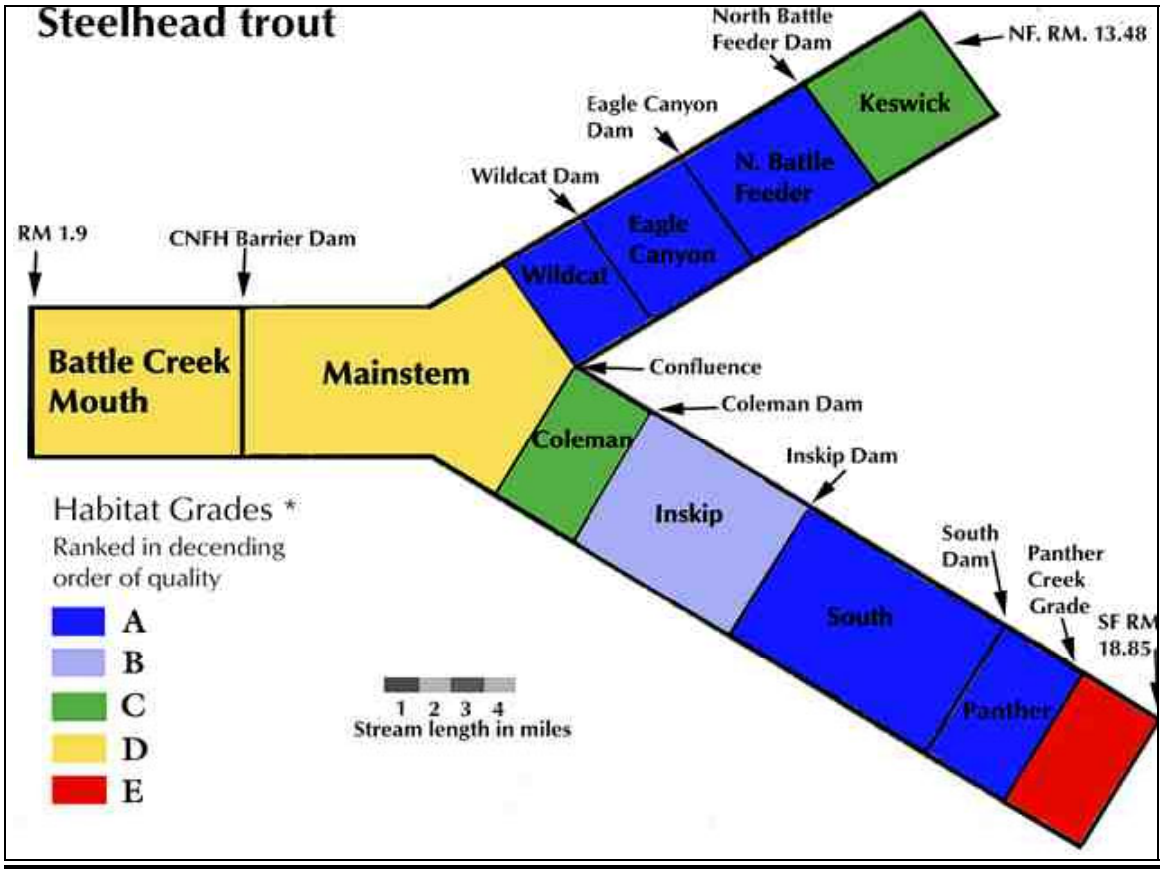
Figure 2. Winter-Run Chinook Salmon Habitat Conceptual Model



Habitat in the Wildcat Reach would be reduced to "C grade" if instream flow releases were insufficient to maintain water temperatures for winter-run chinook incubation at levels that avoid chronic problems.

Habitat prioritization was determined by professional judgment based on restorable temperature regime, cold water accretions from springs, physical habitat characteristics, species life history, length of length of stream reach, stream gradient, and past observations in similar watersheds. For a more descriptive summary of habitat grades see Table 3.

Figure 3. Steelhead Habitat Conceptual Model



Habitat prioritization was determined by professional judgment based on restorable temperature regime, cold water accretions from springs, physical habitat characteristics, species life history, length of stream reach, stream gradient, and past observations in similar watersheds. For a more descriptive summary of habitat grades see Table 3.

Table 3. Description of restored habitat quality grades for spring-run chinook, winter-run chinook, and steelhead assuming maximum potential restoration.

Restored Habitat Quality Grade	Attribute
A	• High elevation and narrow canyon provides cool microclimate • Very large amount of cold water accretion from springs • Water temperature effects on sensitive life stages not measurable on an average year • Secluded adult holding habitat in pools greater than 3 feet deep • Adequate amount of habitat for spawning and juvenile rearing • Little or no competition with fall-run because high stream gradient and instream obstacles limit adult fall-run migration
B	• High elevation and/or narrow canyon provides cool microclimate • Moderate amount of cold water accretion from springs • Average year water temperatures effects on sensitive life stages at or below threshold level of response • Secluded adult holding habitat in pools greater than 3 feet • Adequate amount of habitat for spawning and juvenile rearing • Little of no competition with fall-run because high stream gradient and instream obstacles limit adult fall-run migration
C	• Medium elevation with warm summer microclimate in canyon bottom • Limited amount of cold water accretion from springs • Open canyon provides limited topographic shading • Montane riparian shading present • Average year water temperature effects on sensitive life stage at level of chronic response • Secluded adult holding habitat in pools greater than 3 feet deep • Adequate amount of habitat for spawning and juvenile rearing • Stream gradient and instream obstacles partially limit migration of fall-run to reach • Limited competition with fall-run because stream gradient and instream obstacles partially limit adult fall-run migration • Low elevation with hot summer climate on stream bottom • No cooling influence provided by accretion from springs
D	• Low canyon walls provide little topographic shading • Much montane riparian shading • Average year water temperature effects on sensitive life stages at levels less than 50 percent survival • Partially accessible adult holding habitat with adequate amount of spawning habitat • Adequate pools for adult holding • Water temperature stratification in pools below cold water tributaries • Competition with partially sympatric fall-run
E	• Valley floor reach with hot summer climate • No cooling influence provided by accretions from springs • No topographic shading • Good shading from valley riparian community • Average year water temperature effects on sensitive life stages at less than 25 percent survival • Mostly accessible adult holding habitat • Limited pools for adult holding habitat and juvenile rearing • Adequate amount of spawning habitat • Full competition with sympatric fall-run including superimposition of redds

Table 3. Six Steps of Passive Adaptive Management

1.	Review the available information so as to define the problem as precisely as possible
2.	Think of plausible solutions to the management problem. Describe these in terms of conceptual models of system behavior and its response to possible management interventions.
3.	Subject these solutions to some form of structured analysis (simulation modeling is a useful analytic tool) to determine which offers the greatest promise of success
4.	Specify criteria (indicators, measures) of success or failure of the most promising solution
5.	Implement the most promising solution and monitor the system response according to the criteria developed in step 4.
6.	Adjust the design of the solution from time to time according to the results of monitoring in an attempt to make it work better.

processes. An exhaustive analysis of fish habitat was conducted, which included assessments of instream flows, water temperature, fish passage problems at dams and natural features, and false attraction due to hydroelectric project operations.

The second direction from which a high degree of scientific certainty stems relates to the formulation and design of the proposed Restoration Project. As proposed, the Restoration Project removes the lowest hydroelectric dams located in the North and South Forks (Wildcat Diversion Dam and Coleman Diversion Dam), the so called "gateway" dams to the watershed, thereby providing the greatest level of reliability for fish passage to the upper reaches of the watershed. Where fish screen and ladder facilities are included as project features, these structural fish passage facilities are being designed to higher-level criteria standards tied to flows causing delays in fish passage and to ensure reliable long-term operation and maintenance access. Other dam removals are proposed at key locations (e.g. Soap and Lower Ripley Diversion Dam removals ensure the release of cold water spring resources to the South Fork). All dam removals are then tied to the transfer of hydropower diversion water rights to the California Department of Fish and Game for dedication to instream uses under established State Water Resources Control Board processes. Finally, hydropower facilities are being modified in other ways so as to eliminate false attraction concerns (mixing of North and South Fork water) and flow fluctuations in the natural channels. The Restoration Project as formulated also combines the establishment of a Water Acquisition Fund enabling the purchase of additional flows in the future if deemed necessary, funds for monitoring, an Adaptive Management Fund, and an Adaptive Management Plan and implementation process. These features, triggered after completion of the construction of the physical measures, enable long-term adaptations to the Restoration Project based on future monitoring of the Project's actual performance.

3. Approach –

The proposed Restoration Project incorporates a multifaceted adaptive management approach to restoration that uses the best available science to develop a comprehensive solution to meet fisheries restoration goals and objectives. Combining structural and non-structural measures with an institutional framework and funding that provides for both the long-term assessment of how well the project is achieving restoration goals and a means for making any necessary on-the-ground adjustments provides the greatest

reliability that the investment in the Battle Creek watershed will be a success. Once construction of the physical features is completed and the institutional adaptive management framework is established, an approach is set in place that monitors the effectiveness of the restoration measures taken and allows for modification. Key in the post-construction approach is the establishment of specific criteria that test the underlining scientific hypotheses forming the basis of the Restoration Project. These criteria are used to assess the validity of the underlying assumptions and provide a means to evaluate success in meeting individual goals and objectives. Table 3 summarizes restoration objectives, hypotheses, and associated testing criteria.

The adaptive management restoration approach then builds on these criteria. The approach makes use of detailed monitoring and data assessment approaches for each objective, identified timelines, trigger events, responses, response limits, response evaluations, and end points. The scientific methods and criteria used to test the hypothesis are developed into a monitoring and data assessment approach and are comprised of established and routine procedures, surveys, analysis, and modeling. These scientific methods will comply with all contemporary standard methods and reporting practices that are adopted by CALFED and Resource Agencies as they are developed, with provisions for updating methods based on contemporary scientific norms. For each objective, an implementation schedule, or timeline, is developed. This timeline lists the duration and order of monitoring activities for each objective, and includes trigger events and end points. Trigger events are circumstances indicating that an action, or adaptive response, should be taken because the ecosystem response did not occur as anticipated. If an objective is not being met and a trigger event occurs, then an adaptive response would be required, which could involve further diagnostic studies or modification of the hydroelectric project facilities or operations, or changes to natural features of the Restoration Project Area, designed to bring the system closer to achieving the objective. All responses must be feasible, practical, reasonable, prudent, and acceptable to the local community, though this does not preclude potentially major modifications to project facilities or operations. However, each response has response limits that describe the absolute scope of actions that can be taken in response to a trigger event. End points are a goal and/or circumstance indicating that an objective has been attained and indicating that monitoring and data assessment is no longer needed for that objective. Figure 4 depicts this approach.

4. Feasibility – The January 1999 Restoration Plan formed the foundation for entering into a long-term agreement with PG&E Company (reference June 1999 MOU) for the restoration of anadromous fishery habitat in Battle Creek and its tributaries to facilitate the goals of the CVPIA. Parties to the MOU include, in addition to PG&E Company, the National Marine Fisheries Service, Reclamation, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game. This participation by all of the key resource agencies in a signatory role along with PG&E Company is indicative of the widespread support for the project and demonstrates that implementation is feasible. As part of the design of the project detailed assessments of the projects constructability have been completed and detailed construction schedules are being prepared. No exigencies have been identified that would prevent implementation of the project in times allotted.

Table 3. Criteria for Testing Hypotheses and Success in Meeting Objectives

POPULATION OBJECTIVE 1
Ensure successful salmon and steelhead spawning and juvenile production.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that juvenile salmon and steelhead production is within the expected range given the number of spawning adults and relevant ecological factors.
CRITERIA: • Estimates of pre-project juvenile production • Estimates of adult and jack population sizes and distribution • Estimates of juvenile production at the terminus of the Restoration Project Area upstream of CNFH • Estimates of juvenile production at the terminus of each fork when adult population levels are sufficient to produce statistically detectable numbers of juvenile outmigrants;[2] • Evaluate physical and biological conditions within habitats by reach • Compare juvenile production, by fork and mainstem reach, with production expected from previous spawning populations, in those areas, in light of relevant ecological factors • Compare juvenile production, by fork and mainstem reach, with production observed in Reference Watersheds.
POPULATION OBJECTIVE 2
Restore and recover the assemblage of anadromous salmonids (i.e., winter-run, spring-run, steelhead) that inhabit the stream's cooler reaches during the dry season
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that populations of spring-run, winter-run and steelhead are at Viable Population Levels.
CRITERIA: • Estimates of adult and jack population • Estimates of juvenile production within the Restoration Project Area • Calculate, analyze, and monitor cohort replacement rates (CRR) according to protocols • After population levels are sufficient to reliably calculate CRR, compare 3-year running average CRR with expected CRR • Compare trends in CRR with limiting factors from outside the Restoration Project area using the linked monitoring in the Sacramento River system • Compare trends in CRR with Reference Watersheds.
POPULATION OBJECTIVE 3
Restore and recover the assemblage of anadromous salmonids (i.e., fall-run, late-fall-run) that enter the stream as adults in the wet season and spawn upon arrival.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that populations of fall-run and late-fall-run are at Viable Population Levels.
CRITERIA: • Estimates of adult and jack population sizes and distribution • Estimates of juvenile production within the Restoration Project Area • Calculate, analyze, and monitor cohort replacement rates (CRR) according to protocols • After population levels are sufficient to reliably calculate CRR, compare 3-year running average

[2] Monitoring in both forks is important because of different habitats, limiting factors, and management actions/facilities within each fork.

Table 3. Criteria for Testing Hypotheses and Success in Meeting Objectives (cont.)

CRR with expected CRR • Compare trends in CRR with limiting factors from outside the Restoration Project area using the linked monitoring in the Sacramento River system • Compare trends in CRR with Reference Watersheds
POPULATION OBJECTIVE 4
Ensure salmon and steelhead fully utilize available habitat in a manner that benefits all life stages, thereby maximizing natural production and full utilization of ecosystem carrying capacity.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that, once populations of anadromous salmonids are at Viable Population Levels, the natural production of populations of anadromous salmonids within the Restoration Project Area is maximized based on full utilization of habitat and ecosystem carrying capacity.
CRITERIA: Once each population of anadromous salmonid reaches Viable Population Levels: • Estimates of adult and jack population sizes • Estimate of juvenile within the Restoration Project Area • Define the carrying capacity of each species and life stage of salmon and steelhead and compare populations with expectations of carrying capacity • Determine if natural production in the Restoration Project Area is maximized • Calculate, analyze, and monitor cohort replacement rates (CRR) according to protocols • Compare 3-year running average CRR with expected CRR • Compare long-term CRR trend for a decade and compare with a consistent value of 1.0
HABITAT OBJECTIVE 1
Maximize usable habitat quantity – volume.
HYPOTHESIS: Implementation of instream flow levels specified in the description of the Restoration Project, and implementation of any adaptive responses affecting instream flows, will provide at least 95% of maximum usable habitat quantity for critical life stages among priority species.
CRITERIA: • Compare observations with expected habitat use once there is enough salmon and steelhead to use available areas • Observe and record anadromous salmonid habitat use • Apply any appropriate advancements or refinements that significantly reduce uncertainty in flow/habitat relationships • Flow measurements taken immediately below each dam under the Facilities Monitoring Plan
HABITAT OBJECTIVE 2
Maximize usable habitat quantity – water temperature.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will provide instream water temperatures that are suitable for critical life stages among species at appropriate stream reaches.
CRITERIA: • Climatic conditions within the South Fork watershed • Longitudinal water temperature regime of stream • Flow at springs to which CDFG has conservation water rights • Compare longitudinal water temperature regime with target points within the stream • Compare actual temperature monitoring results with predictions from the best available contemporary water temperature models applied to appropriate stream reaches.

Table 3. Criteria for Testing Hypotheses and Success in Meeting Objectives (cont.)

HABITAT OBJECTIVE 3
Minimize false attraction and harmful fluctuation in thermal and flow regimes due to planned outages or detectable leaks from the hydroelectric project.
HYPOTHESIS: Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that water discharges from the powerhouse tailrace connectors or water conveyance system are confined to times and amounts that avoid false attraction, or biologically significant changes to thermal and chemical regimes.
CRITERIA: • Determine if salmon or steelhead appear to be responding to leakage from powerhouse tailrace connectors or discharges from the water conveyance system • If salmon or steelhead appear to be responding to leakage from powerhouse tailrace connectors or discharges from the water conveyance system, (a) measure leakage or discharges, (b) compare volume of leakage or discharge to streamflow at all times it is known to occur, (c) determine if the discharge measurably alters the thermal or chemical regimes of the South Fork of Battle Creek.[1]
HABITAT OBJECTIVE 4
Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will minimize stranding or isolation of salmon and steelhead due to variations in flow regimes caused by hydroelectric project operations.
HYPOTHESIS: Variation in flow regimes, following forced or scheduled outages where the available diversion flow has been released to the natural stream channel, do not strand salmon and steelhead or isolate them from their habitat when diversions are resumed.
CRITERIA: • Evaluate in the South Fork threshold flow levels above which ramping-rates may differ from 0.1 feet/hour[3] • In the North Fork, conduct a diagnostic study of ramping thresholds to determine the flow level above which ramping rates may differ from 0.1 foot/hour • Collect evidence of fish stranding • Monitor Ramping Rates and threshold flow levels during scheduled outages at appropriate sites to ascertain their effectiveness to avoid stranding and/or isolating anadromous fish from their preferred habitat[4] • Natural flow fluctuations not caused by project operations to ascertain their effect on stranding and/or isolating anadromous salmonids • Compare the stranding effects of project-induced ramping and natural flow fluctuations.
PASSAGE OBJECTIVE 1
Provide reliable upstream passage of salmon and steelhead adults at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams per contemporary engineering criteria and/or standards/guidelines.
HYPOTHESIS: Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities will insure unimpeded passage of Adult salmon and steelhead at fish ladders relative to contemporary criteria and/or standards/guidelines.
CRITERIA • Count anadromous salmonids in fish ladders • Compare ladder counts with spawner distribution and predicted habitat use

[3] CDFG (2001) determined that 460 cfs is an adequate threshold flow below which ramping rates should be applied for the protection of salmon and steelhead downstream of Inskip Dam (and above which, ramping rates need not be applied) following the implementation of the Battle Creek Salmon and Steelhead Restoration Project.

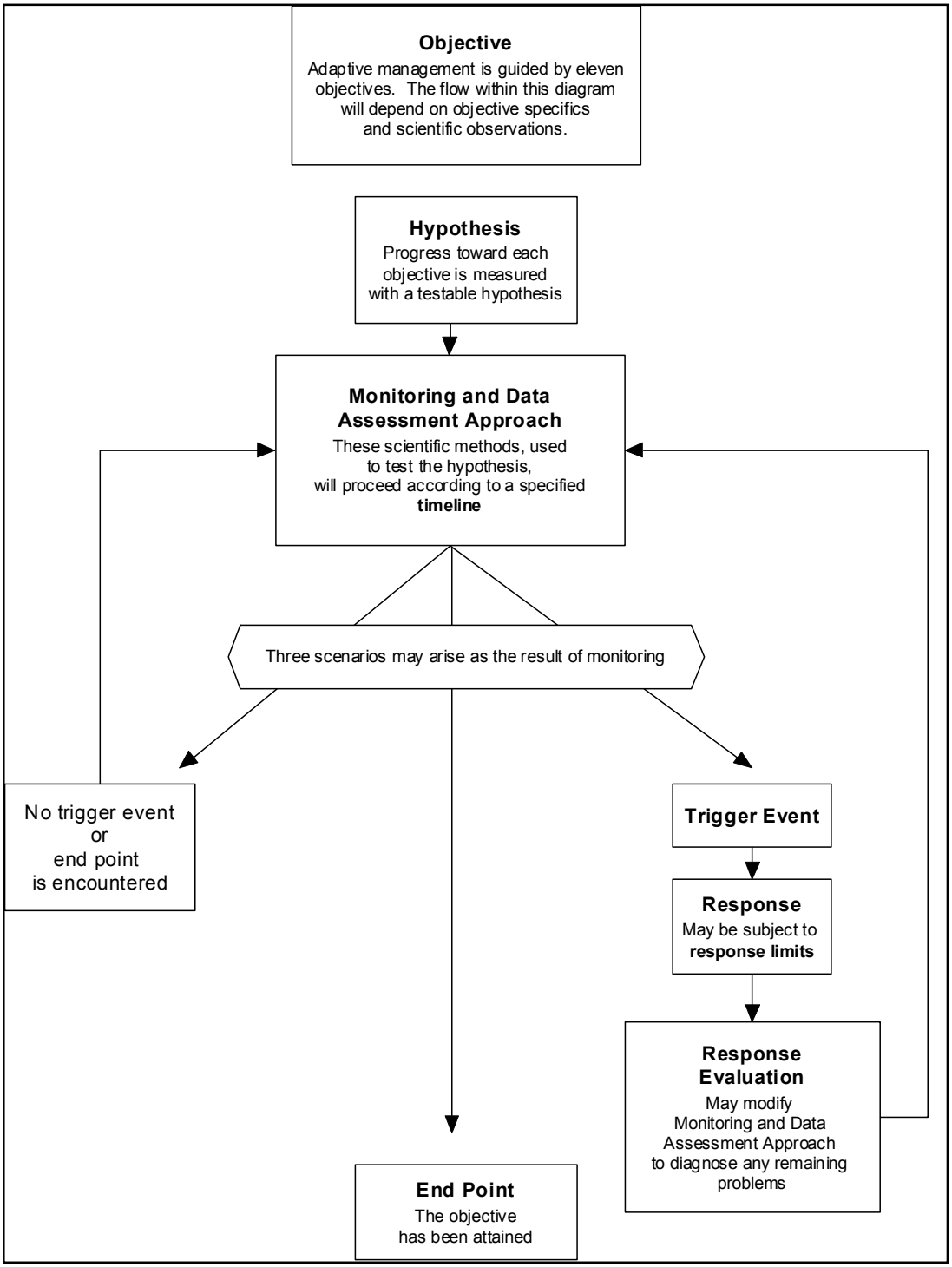
[4] MOU Section 9.1A.2.(c)

Table 3. Criteria for Testing Hypotheses and Success in Meeting Objectives (cont.)

• Evaluate direct evidence of fish injury related to upstream passage at fish ladders • Evaluate fish passage at each ladder with a group of tagged test fish and/or radio tracking • Evaluate the possible unintended downstream-return of upstream-migrating fish ("fall back") over or through diversion dams using tagged fish and/or radio tracking studies • Evaluate underwater observations for congregations of adults below the dam and compare to ladder counts • Meeting key hydraulic parameters continuously for Fail-Safe capabilities according to long-term Operations and Maintenance Plan and Facility Monitoring Plan
PASSAGE OBJECTIVE 2
Provide reliable downstream passage of juveniles at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams per contemporary criteria after the transfer of facilities to Licensee.
HYPOTHESIS: Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that hydraulic parameters at fish screens meet contemporary criteria at all times.
CRITERIA: • Meets contemporary NMFS criteria[5] or subsequent NMFS approved criteria. As per p 73490 in NMFS "4d Rule" • Meets contemporary fish screen criteria for biological effectiveness as it has been affirmed to protect fish from injury and entrainment in applicable studies • At various stream and diversion flow rates, screen sections meet hydraulic parameters such as approach and sweeping velocities, • Meets key hydraulic parameters such as water surface elevation on both sides of fish screens continuously for Fail-Safe capabilities according to long-term Operations and Maintenance Plan and Facility Monitoring Plan • Visual observations of canals, especially at times when canals are dewatered, confirm no entrainment.
PASSAGE OBJECTIVE 3
Provide reliable upstream passage of adult salmon and steelhead to their appropriate habitat over natural obstacles within the Restoration Project area while maintaining an appropriate level of spatial separation among the runs.
HYPOTHESIS Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that Natural instream barriers do not impede upstream migration of adult salmon and steelhead at prescribed flows and normal wet season flow regimes.
CRITERIA: • Inspect potential barriers during annual surveys including photographic documentation and description • Compare spawner distribution relative to suspected barriers • Compare observed spawner distribution relative to expected spawner distribution for a particular species • Use contemporary methodologies that consider flow regime to identify actual barriers[6] • Employ additional diagnostic studies as needed (e.g., radio tracking) if observed spawning differs relative to expected spawning distribution but no specific barrier is identified.

[5] For example, the contemporary fish screening criteria used to generate this plan were adopted from NMFS Southwest Region "Fish Screening Criteria For Anadromous Salmonids, January 1997."
[6] For example, TRPA (1989) methodologies for barrier determination were used to generate this plan.

Figure 4 Post-Construction Approach to Restoration



The proposed Restoration Project is, at the time of this writing, undergoing the preparation of NEPA/CEQA compliance documents as well as a full range of other required permits. A list of applicable permits and their status is found in Table 4.

Table 4. Required Permits

Permit	Status
Local Permits and Approvals	
Tehama County Encroachment Permit	Preparing access road designs in accordance with County standards for road turnouts and intersections with County Rights-of-Way. Preparing Encroachment Permit application. Coordination ongoing.
State Permits and Approvals	
CDFG 1601 Streambed Alteration	Preparing Application. Coordination ongoing.
CWA Section 401 Water Quality Certification	Preparing Application. Coordination ongoing.
Federal Permits and Approvals	
ESA Section 7 Consultation	Draft Biological Assessment under Review. Coordination ongoing.
CWA Section 404	Preparing Application. Coordination ongoing.

5. Performance Measures –

A full monitoring plan is included in the Draft Adaptive Management Plan (Ward, 2001). This plan includes, as discussed in "Section 3. Approach" of this proposal, a full discussion of monitoring and data assessment methods, monitoring timelines, trigger events defining performance measures, potential response measures and limits, response evaluations, and end points. A summary of monitoring parameters is found in Table 5. Table 6 delineates how performance measures will be applied to evaluating the effectiveness of the restoration actions and how they will be used to trigger modifications to restoration activities if necessary. At the time of preparation of this proposal the Adaptive Management Plan and associated performance measures is under review by the CALFED Science Review Program.

Primary monitoring responsibilities associated with the proposed project lie with PG&E Company, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game. Details of specific monitoring actions are more fully delineated in separate CALFED proposals by the U.S. Fish and Wildlife Service. The monitoring proposed under this proposal is being incorporated into existing monitoring programs being conducted by the Fish and Wildlife Service. Additional monitoring may be conducted by the California Department of Fish and Game. Some monitoring aspects may also be conducted under the auspices of the Battle Creek Watershed Conservancy. Monitoring, if any, to be conducted under the guidance of the Battle Creek Watershed Conservancy needs further refinement.

Table 5. Monitoring Activities Summary

Monitoring Tasks	Task Type	Objective	Responsibility	Timeline	Estimated Annual Cost
Estimate adult and jack population sizes using Coleman barrier weir.	field study	POP-1, POP-2, POP-3, POP-4	Resource Agencies	13 – 16 years minimum	**A** $50,000
– Compare 3 year-running average CRR with expected CRR when populations allow	analysis	POP-2, POP-3, POP-4	Resource Agencies	13 – 16 years minimum	included in A
– Evaluate CRR trends in light of limiting factors in the Sacramento River system	analysis	POP-2, POP-3	Resource Agencies	13 – 16 years minimum	included in A
– Compare CRR to Reference Watersheds	analysis	POP-2, POP-3	Resource Agencies	13 – 16 years minimum	included in A
– Compare CRR 10-year trend to CRR value of 1.0	analysis	POP-4	Resource Agencies	Term of AMP	included in A
Count adult and jack anadromous salmonids using video and electronic methods at ladders	field study	PASS-1	Licensee[7]	3 years or longer per AMP protocols	proprietary information
Estimate adult and jack anadromous salmonid sub-population sizes and distribution by reach using counting facilities at new fish ladders, after PASS-1 is done.	field study	POP-1	Resource Agencies[7]	After Licensee's responsibility ends until no longer needed	$30,000
Estimate juvenile production when adult populations are large enough to produce detectable numbers of outmigrants	field study	POP-1, POP-2, POP-3, POP-4	Resource Agencies	Term of AMP	**B** $250,000

[7] Pursuant to the MOU as explained in Passage Objective 1 and the Facilities Monitoring Plan, the Licensee is expected to operate video and electronic counting equipment to count adult and jack anadromous salmonids for the first three years, or longer per AMP protocols, after the transfer of facilities from USBR to PG&E. The Resource Agencies will take over these fish counting responsibilities to satisfy Population Objective 1 at the end of the Licensee's obligation.

Table 5. Monitoring Activities Summary (cont.)

Monitoring Tasks	Task Type	Objective	Responsibility	Timeline	Estimated Annual Cost
– Compare juvenile production to expected production from previous spawners and ecological factors	analysis	POP-1	Resource Agencies	Term of AMP	included in B
– Compare juvenile production to production observed in Reference Watersheds	analysis	POP-1	Resource Agencies	Term of AMP	included in B
Estimate pre-project juvenile production	field study	POP-1	Resource Agencies	1998-2002	$250,000
Estimate juvenile production at the terminus of each fork when adult populations are large enough to produce detectable numbers of outmigrants	field study	POP-1	Resource Agencies	5 years, 2002-2007	$100,000
Estimate adult and jack distribution using carcass counts, snorkel surveys, and /or redd surveys	field study	POP-1, POP-2, POP-3, POP-4, PASS-1, PASS-3	Resource Agencies	Term of AMP	**C** $155,000
– Evaluate physical and biological habitat conditions for each reach	field study	POP-1	Resource Agencies	Term of AMP	included in C
– Observe and record habitat use, and compare observed habitat use to expected habitat use	field study	HAB-1	Resource Agencies	Term of AMP	included in C
– Gauge salmon or steelhead response to tailrace leaks or discharge of water	field study	HAB-3	Resource Agencies	Term of AMP	included in C
– Monitor Ramping Rates and threshold flow levels for effects on stranding or isolating	field study	HAB-4	Resource Agencies	During scheduled outages 2002-2007	included in C
– Monitor fish stranding	field study	HAB-4	Resource Agencies	Term of AMP	included in C

Table 5. Monitoring Activities Summary (cont.)

Monitoring Tasks	Task Type	Objective	Responsibility	Timeline	Estimated Annual Cost
– Monitor natural flow fluctuations for affects on stranding and isolating	field study	HAB-4	Resource Agencies	Conducted in 2000-2007	included in C
– Compare stranding and isolating effects of natural flow fluctuations and project induced ramping	analysis	HAB-4	Resource Agencies	Completed 2007	included in C
– Inspect potential barriers during annual surveys	field study	PASS-3	Resource Agencies	Term of AMP	included in C
– Compare spawner distribution relative to suspected barriers	analysis	PASS-3	Resource Agencies	Term of AMP	included in C
– Compare ladder counts with spawning distribution and predicted habitat use.	analysis	PASS-1, POP-1	Resource Agencies	Term of AMP	Included in C
– Compare observed spawner distribution relative to expected spawner distribution for a particular species	analysis	PASS-3	Resource Agencies	Term of AMP	included in C
– Document fish injury caused by fish ladders	field study	PASS-1	Resource Agencies	Term of AMP	included in C
– Observe adult congregations below dam and compare to ladder counts	field study	PASS-1	Resource Agencies	Term of AMP	included in C
Use contemporary methodologies that consider flow regime to identify actual barriers	field study	PASS-3	Resource Agencies	contingent on need	contingent on need
Diagnose threshold flow on the North Fork at which Ramping Rates differ from 0.1 foot/hour	field study	HAB-4	Resource Agencies	During scheduled outages 2001-2003	$10,000
Monitor longitudinal water temperature regime	field study	HAB-2, POP-1	Resource Agencies	5 years minimum	$20,000

Table 5. Monitoring Activities Summary (cont.)

Monitoring Tasks	Task Type	Objective	Responsibility	Timeline	Estimated Annual Cost
Monitor cold water from Bluff Springs	field study	HAB-2	Resource Agencies	Term of AMP	none
Monitor water temperature at target points within stream	field study	HAB-2, POP-1	Resource Agencies	Term of AMP	$5,000
Monitor climatic conditions	field study	HAB-2, POP-1	Resource Agencies	5 years minimum	$13,000 first year and $3,000 thereafter
Monitor leaks and discharge for indications that it alters the South Fork thermal or chemical regime	field study	HAB-3	Licensee	Term of AMP	proprietary information
Compare leakage or discharge to stream flow rates	analysis	HAB-3	Licensee	Term of AMP	proprietary information
Monitor hydraulic parameters at fish ladders for Fail-Safe capabilities	field study	PASS-1	Licensee	Term of AMP	proprietary information
Measure and compare hydraulic parameters at fish screens for calculated and measured diversion rates	field study	PASS-2	Licensee	Measure as relevant throughout the OMP	proprietary information
Monitor key hydraulic parameters at fish screens for Fail-Safe capabilities	field study	PASS-2	Licensee	Continuously throughout AMP	proprietary information
Observe canals for entrainment during other activities and when dewatered	field study	PASS-2	Licensee	Continuously throughout AMP	proprietary information

Table 5. Monitoring Activities Summary (cont.)

Monitoring Tasks	Task Type	Objective	Responsibility	Timeline	Estimated Annual Cost
Possible Adaptive Management Diagnostic Studies	**Task Type**	**Objective**	**Responsibility**	**Timeline**	**Estimated Annual Cost**
Water temperature modeling	diagnostic analysis	HAB-2	Resource Agencies	5 years	unknown
Apply advancements in flow/habitat relationships	diagnostic analysis	HAB-1	Resource Agencies, Licensee	To be determined	unknown
Study fish passage at ladders with tagged test fish	diagnostic field study	PASS-1	Resource Agencies	Term of AMP	unknown
Monitor fallback with tagged test fish	diagnostic field study	PASS-1	Resource Agencies	Term of AMP	unknown
Conduct a diagnostic study of ramping thresholds in the North Fork to determine the flow level above which ramping rates may differ from 0.1 foot/hour.	diagnostic field study	HAB-4	Resource Agencies	Term of AMP	unknown

Table 6. Performance Measures

POPULATION OBJECTIVE 1
Ensure successful salmon and steelhead spawning and juvenile production.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that juvenile salmon and steelhead production is within the expected level given the number of spawning adults and relevant ecological factors..
MONITORING AND DATA ASSESSMENT APPROACH: (1) Establish pre-project estimates of juvenile production using outmigrant traps at the terminus of the Restoration Project Area upstream of CNFH;[8] (2) Estimate adult and jack population sizes and distribution using adult counts at fish ladders, carcass counts, snorkel surveys, and/or redd surveys; (3) Estimate juvenile production using an out-migrant trap at the terminus of the Restoration Project Area upstream of CNFH; (4) Estimate juvenile production using outmigrant traps at the terminus of each fork during years and seasons as needed, when adult population levels are sufficient to produce statistically detectable numbers of juvenile outmigrants;[9] (5) Evaluate physical and biological conditions within habitats by reach; (6) Compare juvenile production, by fork and mainstem reach, with production expected from previous spawning populations, in those areas, in light of relevant ecological factors; (7) Compare juvenile production, by fork and mainstem reach, with production observed in Reference Watersheds.
TIMELINE: (1) Each monitoring and data assessment approach applies separately for each run of salmon and steelhead to reflect the diversity of life histories;[10] (2) Sample juvenile production when adult population levels are sufficient to produce statistically detectable numbers of juvenile outmigrants; (3) Sample, when feasible, juvenile production during all periods of juvenile movement; (4) Sample juvenile production especially during drought.
TRIGGER EVENT: Juvenile production not within expected range given the number of spawning adult salmon and steelhead and relevant ecological factors. For example, if a year-class failure occurs in Battle Creek but not in Reference Watersheds.
RESPONSE: (1) If the limiting factor is flow-related, then the response would be that set forth in Habitat Objective 1; (2) If the limiting factor is water temperature-related, then the response would be that set forth in Habitat Objective 2; (3) If the limiting factor is unidentifiable after testing hypotheses from all habitat and passage objectives, then identify unanticipated limiting factors and work to eliminate those factors that are controllable and related to the Restoration Project.[11]
RESPONSE LIMITS: (1) If the limiting factor is identified by testing hypotheses from any of the habitat and passage objectives, then the response limits would be based on the appropriate objective; (2) If the limiting factor is not associated with any of the objectives, but is controllable and related to the Restoration Project, then the response limit will be any action deemed feasible, practical, reasonable, prudent, acceptable to the local community, and consistent with MOU and FERC protocols, provided that Consensus has been reached among the Parties.
RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: (1) There is no end point for juvenile production monitoring at the terminus of the Restoration Project Area upstream of CNFH; (2) There is no end point for estimating adult and jack population sizes; (3) Trapping on the forks will continue until the AMTT decides it is no longer necessary (i.e., the hypothesis is met during a reasonable number of years of extreme water conditions);

[8] Establishing pre-project estimates of production are important to prove the results of the Restoration Project, as a foundation for adaptive management, and to comply with CAMP protocols. Pre-project production estimates would be made under the present interim flow agreement and present screw-trapping and snorkeling surveys. Some limited data collected during the period of FERC-required flows exist.

[9] Monitoring in both forks is important because of different habitats, limiting factors, and management actions/facilities within each fork.

[10] See Ward and Kier (1999a) for life history information.

[11] The response to factors that are controllable but not related to the Restoration Project will depend on the appropriate agency initiatives identified in the "Linkages" section of the AMP. Identification of uncontrollable factors could lead to a reassessment of "relevant ecological factors."

Table 6. Performance Measures (cont.)

(4) Comparisons of actual versus expected juvenile production, and comparisons with Reference Watersheds are terminated when Population Objective 4 has been reached and juvenile production is within the expected range.
REPORTING: Per standard data management and reporting procedures
RESPONSIBILITY/FUNDING: (1) Licensee will conduct and/or fund, up to the Licensee's Commitment, adult counts at fish ladders in the initial three-year period of operation. Pursuant to adaptive management protocols, if salmon and steelhead populations are insufficient to affirm ladder effectiveness under continuous duty, then Licensee will conduct and/or fund adult counts at fish ladders for a longer period of time to be determined by mutual agreement per protocols. (2) Resource Agencies will, subject to available funds, conduct and/or fund or seek funding for other monitoring and data assessments.
POPULATION OBJECTIVE 2
Restore and recover the assemblage of anadromous salmonids (i.e., winter-run, spring-run, steelhead) that inhabit the stream's cooler reaches during the dry season.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that populations of spring-run, winter-run and steelhead are at Viable Population Levels.
MONITORING AND DATA ASSESSMENT APPROACH: (1) Estimate adult and jack population sizes using adult counts at fish ladders, carcass counts, snorkel surveys, and/or redd surveys; (2) Estimate juvenile production using out-migrant traps within the Restoration Project Area; (3) Calculate, analyze, and monitor cohort replacement rates (CRR) according to protocols; (4) After population levels are sufficient to reliably calculate CRR, compare 3-year running average CRR with expected CRR; (5) Compare trends in CRR with limiting factors from outside the Restoration Project area using the linked monitoring in the Sacramento River system; (6) Compare trends in CRR with Reference Watersheds.
TIMELINE: (1) Each monitoring and data assessment approach applies separately for each run of salmon and steelhead to reflect the diversity of life histories; (2) Estimates of adult population size and juvenile production will be made throughout the term of the AMP or until this Objective is met; (3) CRR protocols suggest that calculation and analysis of CRR will continue for a minimum of 13 years plus 3 years and will likely extend for at least the term of the AMP.
TRIGGER EVENT: The three-year running average CRR falls below 1.0 after CRR can be reliably calculated according to CRR protocols above, and trends in CRR differ from CRR trends in Reference Watersheds.
RESPONSE: (1) If the limiting factor is flow-related, then the response would be that set forth in Habitat Objective 1; (2) If the limiting factor is water temperature-related, then the response would be that set forth in Habitat Objective 2; (3) If the limiting factor is unidentifiable after testing hypotheses from all habitat and passage objectives, then identify unanticipated limiting factors and work to eliminate those factors that are controllable and related to the Restoration Project.[12]
RESPONSE LIMITS: (1) If the limiting factor is identified by testing hypotheses from any of the habitat and passage objectives, then the response limits would be based on the appropriate objective; (2) If the limiting factor is not associated with any of the objectives, but is controllable and related to the Restoration Project, then the response limit will be any action deemed feasible, practical, reasonable, prudent, acceptable to the local community, and consistent with MOU and FERC protocols, provided that Consensus has been reached among the Parties.
RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: Continue these monitoring and data assessment approaches, separately for each run of salmon and steelhead, until populations reach Viable Population Levels.
REPORTING: Per standard data management and reporting procedures

[12] The response to factors that are controllable but not related to the Restoration Project will depend on the appropriate agency initiatives identified in the "Linkages" section of the AMP. Identification of uncontrollable factors could lead to a reassessment of "relevant ecological factors."

Table 6. Performance Measures (cont.)

RESPONSIBILITY/FUNDING: (1) Licensee will conduct and/or fund, up to the Licensee's Commitment, adult counts at fish ladders in the initial three-year period of operation. Pursuant to adaptive management protocols, if salmon and steelhead populations are insufficient to affirm ladder effectiveness under continuous duty, then Licensee will conduct and/or fund adult counts at fish ladders for a longer period of time to be determined by mutual agreement per protocols. (2) Resource Agencies will, subject to available funds, conduct and/or fund or seek funding for other monitoring and data assessments. (3) NMFS will define recovery goals for anadromous salmonid species in Battle Creek listed under the ESA at any time during the term of the AMP.
POPULATION OBJECTIVE 3
Restore and recover the assemblage of anadromous salmonids (i.e., fall-run, late-fall-run) that enter the stream as adults in the wet season and spawn upon arrival.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that populations of fall-run and late-fall-run are at Viable Population Levels.
MONITORING AND DATA ASSESSMENT APPROACH: (1) Estimate adult and jack population sizes and distribution using adult counts at fish ladders, carcass counts, snorkel surveys, and/or redd surveys; (2) Estimate juvenile production using out-migrant traps within the Restoration Project Area; (3) Calculate, analyze, and monitor cohort replacement rates (CRR) according to protocols; (4) After population levels are sufficient to reliably calculate CRR, compare 3-year running average CRR with expected CRR; (5) Compare trends in CRR with limiting factors from outside the Restoration Project area using the linked monitoring in the Sacramento River system; (6) Compare trends in CRR with Reference Watersheds.
TIMELINE: (1) Each monitoring and data assessment approach applies separately for each run of salmon to reflect the diversity of life histories; (2) Estimation of adult population size and juvenile production will be made throughout the term of the AMP or until this Objective is met; (3) CRR protocols suggest that calculation and analysis of CRR will continue for a minimum of 13 years plus 3 years and will likely extend for at least the term of the AMP.
TRIGGER EVENT: The three-year running average CRR falls below 1.0 after CRR can be reliably calculated according to CRR protocols above and trends in CRR differ from CRR trends in Reference Watersheds.
RESPONSE: (1) If the limiting factor is flow-related, then the response would be that set forth in Habitat Objective 1; (2) If the limiting factor is water temperature-related, then the response would be that set forth in Habitat Objective 2; (3) If the limiting factor is unidentifiable after testing hypotheses from all habitat and passage objectives, then identify unanticipated limiting factors and work to eliminate those factors that are controllable and related to the Restoration Project.[13]
RESPONSE LIMITS: (1) If the limiting factor is identified by testing hypotheses from any of the habitat and passage objectives, then the response limits would be based on the appropriate objective; (2) If the limiting factor is not associated with any of the objectives, but is controllable and related to the Restoration Project, then the response limit will be any action deemed feasible, practical, reasonable, prudent, acceptable to the local community, and consistent with MOU and FERC protocols, provided that Consensus has been reached among the Parties.
RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: Continue these monitoring and data assessment approaches, separately for each run of salmon and steelhead, until populations reach Viable Population Levels.
REPORTING: Per standard data management and reporting procedures
RESPONSIBILITY/FUNDING: (1) Licensee will conduct and/or fund, up to the Licensee's Commitment,

[13] The response to factors that are controllable but not related to the Restoration Project will depend on the appropriate agency initiatives identified in the "Linkages" section of this report. Identification of uncontrollable factors could lead to a reassessment of "relevant ecological factors."

adult counts at fish ladders in the initial three-year period of operation. Pursuant to adaptive management protocols, if salmon and steelhead populations are insufficient to affirm ladder effectiveness under continuous duty, then Licensee will conduct and/or fund adult counts at fish ladders for a longer period of time to be determined by mutual agreement per protocols. (2) Resource Agencies will, subject to available funds, conduct and/or fund or seek funding for other monitoring and data assessments. (3) NMFS will define recovery goals for anadromous salmonid species in Battle Creek listed under the ESA including species that may not be listed at the time the AMP was originally drafted.
POPULATION OBJECTIVE 4
Ensure salmon and steelhead fully utilize available habitat in a manner that benefits all life stages, thereby maximizing natural production and full utilization of ecosystem carrying capacity.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that, once populations of anadromous salmonids are at Viable Population Levels, the natural production of populations of anadromous salmonids within the Restoration Project Area is maximized based on full utilization of habitat and ecosystem carrying capacity.
MONITORING AND DATA ASSESSMENT APPROACH: (1) Perform monitoring for this objective once each population of anadromous salmonid reaches Viable Population Levels; (2) Estimate adult and jack population sizes using adult counts at fish ladders, carcass counts, snorkel surveys, and/or redd surveys; (3) Estimate juvenile production using out-migrant traps and other contemporary sampling techniques within the Restoration Project Area; (4) Define the carrying capacity of each species and life stage of salmon and steelhead and compare populations with expectations of carrying capacity; (5) Determine if natural production in the Restoration Project Area is maximized; (6) Calculate, analyze, and monitor cohort replacement rates (CRR) according to protocols; (7) Compare 3-year running average CRR with expected CRR; (8) Compare long-term CRR trend for a decade and compare with a consistent value of 1.0.
TIMELINE: (1) Each monitoring and data assessment approach applies separately for each species of salmon or steelhead to reflect the diversity of life histories; (2) Estimation of adult population size and juvenile production will be made throughout the term of the AMP or until this Objective is met; (3) CRR protocols suggest that calculation and analysis of CRR will continue for a minimum of 13 years plus 3 years and will likely extend for at least the term of the AMP.
TRIGGER EVENT: (1) The three-year running average CRR falls below 1.0 after Viable Populations Levels have been reached, and long-term trends in CRR differ from CRR trends in Reference Watersheds; (2) CRR reach a consistent value of 1.0 for several generations but the populations size(s) are less than the expected carrying capacity; (3) Natural production of any species or life history stage in the Restoration Project Area is less than expected levels of production.
RESPONSE: If CRR falls below 1.0 and long-term trends differ from Reference Watersheds, or if CRR stabilizes at 1.0 but the populations sizes are lower than expected, or if natural production of any species or life history stage is less than expected, then identify unanticipated limiting factors, and either work to eliminate those factors that are controllable, related to the Restoration Project, and within response limits, or refine estimates of expected carrying capacity.
RESPONSE LIMITS: (1) If the limiting factor is identified by testing hypotheses from any of the habitat and passage objectives, then the response limits would be based on the appropriate objective; (2) If the limiting factor is not associated with any of the objectives, but is controllable and related to the Restoration Project, then the response limit will be any action deemed feasible, practical, reasonable, prudent, acceptable to the local community, and consistent with MOU and FERC protocols, provided that Consensus has been reached among the Parties.
RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: Continue these monitoring and data assessment approaches, separately for each run of salmon and steelhead, until natural production within the Restoration Project Area is maximized and ecosystem carrying capacity is fully utilized.
REPORTING: Per standard data management and reporting procedures

Table 6. Performance Measures (cont.)

RESPONSIBILITY/FUNDING: (1) Licensee will conduct and/or fund, up to the Licensee's Commitment, adult counts at fish ladders in the initial three-year period of operation. Pursuant to adaptive management protocols, if salmon and steelhead populations are insufficient to affirm ladder effectiveness under continuous duty, then Licensee will conduct and/or fund adult counts at fish ladders for a longer period of time to be determined by mutual agreement per protocols. (2) Resource Agencies will, subject to available funds, conduct and/or fund or seek funding for other monitoring and data assessments.
HABITAT OBJECTIVE 1
Maximize usable habitat quantity – volume.
HYPOTHESIS: Implementation of instream flow levels specified in the description of the Restoration Project, and implementation of any adaptive responses affecting instream flows, will provide at least 95% of maximum usable habitat quantity for critical life stages among priority species.
MONITORING AND DATA ASSESSMENT APPROACH: (1) Compare observations with expected habitat use once there is enough salmon and steelhead to use available areas; (2) Observe and record anadromous salmonid habitat use during the course of other monitoring studies; (3) Apply any appropriate advancements or refinements that significantly reduce uncertainty in flow/habitat relationships; (4) examine flow monitoring measurements taken immediately below each dam for the Facilities Monitoring Plan.
TIMELINE: (1) Apply appropriate, significant advancements in instream flow analysis as they become available; (2) Apply appropriate habitat use data as it is accumulated.
TRIGGER EVENT: (1) Significant advancements or refinements arise that reduce uncertainty in flow/habitat relationships and indicate that changes to instream flows are needed; (2) Observed habitat use is not consistent with expected habitat use at a time when there are enough salmon and steelhead to get a reliable data set.
RESPONSE: (1) Incorporate significant advancements or refinements into existing or new instream flow models, (2) If observations of habitat use are not consistent with expected habitat use, then conduct a verification study of anadromous salmonid habitat use according to contemporary protocols; (3) If suggested by the verification study, then develop new habitat suitability criteria; (4) Recommend changing instream flows as appropriate consistent with MOU and FERC protocols.
RESPONSE LIMITS: All minimum instream flow changes deemed feasible, practical, reasonable, prudent, acceptable to the local community, and consistent with MOU and FERC protocols, will be implemented, provided that Consensus has been reached among the Parties and dedicated funding is available. If Consensus has not been reached, then minimum flow changes will be determined through the dispute resolution process.
RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: None.
REPORTING: Per standard data management and reporting procedures
RESPONSIBILITY/FUNDING: Resource Agencies will, subject to available funds, conduct and/or fund or seek funding for data collection and report preparation. Other programs (e.g., CVPIA and CALFED) would be solicited to fund additional diagnostic assessment tools to design a proper response (e.g., instream flow modeling). Water acquisition would be funded by the WAF, and AMF upon exhaustion of WAF. If both funds are exhausted and Consensus is reached, the Licensee funds water acquisition up to the Licensee's commitment. If both funds are exhausted and Consensus is not reached, funding of minimum instream flows will be determined through the dispute resolution process, up to the Licensee's commitment.
HABITAT OBJECTIVE 2
Maximize usable habitat quantity – water temperature.
HYPOTHESIS: Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will provide instream water temperatures that are suitable for critical life stages among species at appropriate stream reaches.
MONITORING AND DATA ASSESSMENT APPROACH: (1) Monitor climatic conditions within the

Table 6. Performance Measures (cont.)

South Fork watershed by establishing an appropriate weather station to support water temperature modeling efforts; (2) Monitor longitudinal water temperature regime of stream to determine attainability of water temperature goals[14] for each stream reach; (3) CDFG will monitor any springs to which it has conservation water rights; (4) Compare longitudinal water temperature regime with target points within the stream; (5) Compare monitoring results with predictions from the best available contemporary water temperature models applied to appropriate stream reaches.
TIMELINE: (1) Monitor climatic and longitudinal water temperature regime for at least five years for system-wide water temperature monitoring including at least at least one year of dry/hot conditions; (2) Maintain key water temperature monitoring stations at appropriate locations for the term of the AMP.
TRIGGER EVENT: Water temperature goals are not attained in specific reaches under climatic conditions when attainment is expected.
RESPONSE: (1) Apply the best available contemporary water temperature model to determine if water temperature goals could be met and/or exceeded under different climatic conditions by changing instream flows or spring releases from hydroelectric project water collection facilities; (2) If so indicated by the model, develop a rule-based plan[15] for short-term changes in the flows to reduce water temperatures to target ranges during hot weather[16], and perform a verification test of project operations according to the rule-based plan to determine if water temperature goals could be achieved; (3) Acquire water and/or spring releases from hydroelectric project water collection facilities to increase instream flows as needed.
RESPONSE LIMITS: All instream flow changes for water temperature adjustment deemed feasible, practical, reasonable, prudent, acceptable to the local community, and consistent with MOU and FERC protocols, will be implemented, provided that Consensus has been reached among the Parties and dedicated funding is available. If Consensus has not been reached, then instream flow changes for water temperature adjustment will be determined through the dispute resolution process.
RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: (1) Monitoring the longitudinal water temperature regime would end after the AMTT determines the attainability of water temperature goals for each stream reach; (2) Prescriptive actions under the rule-based plan for selected water temperature target points would remain in effect for the term of the AMP; (3) There is no end point for key water temperature monitoring stations.
REPORTING: Per standard data management and reporting procedures. The annual adaptive management report will summarize all data collected under these monitoring and data assessment approaches and will present analyses required herein during the development of the rule-based plan and during implementation of the rule-based plan. Periodic updates of summarized raw data will be made to match the frequency of meetings of the Adaptive Management Technical Team.
RESPONSIBILITY/FUNDING: Resource Agencies will, subject to available funds, conduct and/or fund or seek funding sources other than Licensee for water temperature and climatic data collection. Other programs (e.g., CVPIA and CALFED) would be solicited to fund additional diagnostic assessment tools to design a proper response (e.g., water temperature modeling). Water acquisition would be funded by the WAF, and AMF upon exhaustion of WAF. If both funds are exhausted and Consensus is reached, the Licensee funds water acquisition up to the Licensee's commitment. If both funds are exhausted and Consensus is not reached, funding of water acquisition will be determined through the dispute resolution process, up to the Licensee's commitment.

[14] Specific temperature goals for each reach based on temperature criteria and geographic prioritization are described in the *Battle Creek Salmon and Steelhead Restoration Plan*. The post-Restoration Project operations will be monitored to examine attainability under different controllable factors.

[15] The rule-based plan would provide hydroelectric project operators with a predictive model that would allow them to adjust flow for the next day based on the current day's observed water temperatures and other variables. This rule-based plan will consider geographical limits and/or the attainability of temperature criteria, it will contain an allowance for deviations from criteria, and it will contain enough flexibility to cope with contingencies. This rule-based plan would be developed based on established temperature protocols such as the NMFS draft temperature guidelines.

[16] There may be a need to balance temperature control with other habitat effects of flow changes, but based on action priorities developed herein, temperature control may take priority over other habitat effects.

Table 6. Performance Measures (cont.)

HABITAT OBJECTIVE 3
Minimize false attraction and harmful fluctuation in thermal and flow regimes due to planned outages or detectable leaks from the hydroelectric project.[17]
HYPOTHESIS: Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that water discharges from the powerhouse tailrace connectors or water conveyance system are confined to times and amounts that avoid false attraction, or biologically significant changes to thermal and chemical regimes. [18]
MONITORING AND DATA ASSESSMENT APPROACH: (1) During the course of other monitoring studies, determine if salmon or steelhead appear to be responding to leakage from powerhouse tailrace connectors or discharges from the water conveyance system; (2) If salmon or steelhead appear to be responding to leakage from powerhouse tailrace connectors or discharges from the water conveyance system, (a) measure leakage or discharges, (b) compare volume of leakage or discharge to streamflow at all times it is known to occur, (c) determine if the discharge measurably alters the thermal or chemical regimes of the South Fork of Battle Creek.[1]
TIMELINE: Continue monitoring and data assessment approaches for the term of the AMP.
TRIGGER EVENT: (1) Direct evidence of an adverse fish response to leakages or discharges from the hydroelectric project is observed; (2) Facilities monitoring identifies and estimates significant intentional or unintentional release from the powerhouse tailrace connectors or discharge from the water conveyance system to the South Fork.
RESPONSE: Restore isolation of water in the powerhouse tailrace connectors and/or water conveyance system from the South Fork of Battle Creek.
RESPONSE LIMITS: Restore isolation to the extent that it is practical and feasible by contemporary engineering practices for water conveyance structures provided that actions do not threaten the safety of the water conveyance system and dedicated funding is available.
RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: None
REPORTING: Per the Facilities Monitoring Plan. Per standard data management procedures.
RESPONSIBILITY/FUNDING: Installation costs of new/additional facilities required to meet contemporary criteria or modification of existing facilities to avoid fish injury or mortality would be paid by Adaptive Management Fund protocols. However, in the event that the Adaptive Management Fund is exhausted, the Licensee will pay up to the Licensee's Commitment for Authorized Modifications to project facilities which are determined to be necessary under adaptive management. (1) Licensee conducts and/or funds the facilities monitoring consistent with the Facilities Monitoring Plan, including recording the timing and estimated amounts of water released from the canal gates and spill channels during known releases from the conveyance system; (2) Resource Agencies will, subject to available funds, conduct and/or fund or seek funding sources other than the Licensee for relevant biological monitoring and measurement of any unintentional leakage or discharge that elicits a response from salmon or steelhead.
HABITAT OBJECTIVE 4
Minimize stranding or isolation of salmon and steelhead due to variations in flow regimes caused by hydroelectric project operations.

[17] Planned outages from the powerhouse tailrace connectors or water conveyance system to the South Fork will occur during the period from February 1 through April 30, as specified in the MOU, and will be monitored per the Facilities Monitoring Plan. Forced outages are not covered under this AMP because they are assumed to occur infrequently and under emergency situations, and produce discharges of relatively short duration. In the event that these assumptions are not met, this objective could be modified to include forced outages. Emergencies are addressed in the AMP protocol section.

[18] "Chemical" in this sense refers to chemical constituents of stream water at detectable levels that may be used by migrating salmonids for homing or spawning area recognition.

Table 6. Performance Measures (cont.)

HYPOTHESIS: Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that variations in flow regimes, following forced or scheduled outages where the available diversion flow has been released to the natural stream channel, do not strand salmon and steelhead or isolate them from their habitat when diversions are resumed.
MONITORING AND DATA ASSESSMENT APPROACH: (1) In the course of other monitoring studies, evaluate, in the South Fork, threshold flow levels above which ramping-rates may differ from 0.1 feet/hour[19]; (2) In the North Fork, conduct a diagnostic study of ramping thresholds to determine the flow level above which ramping rates may differ from 0.1 foot/hour; (3) Collect evidence of fish stranding during the course of other monitoring studies; (4) Monitor Ramping Rates and threshold flow levels during scheduled outages at appropriate sites to ascertain their effectiveness to avoid stranding and/or isolating anadromous fish from their preferred habitat[20]; (5) Monitor natural flow fluctuations not caused by project operations to ascertain their effect on stranding and/or isolating anadromous salmonids; (6) Compare the stranding effects of project-induced ramping and natural flow fluctuations.
TIMELINE: (1) The diagnostic study of threshold flows in the North Fork will be completed the first time flow conditions are appropriate and may occur as early as spring 2001; (2) Evidence of fish stranding will be collected through the term of the AMP, (3) Monitoring of Ramping Rates will be conducted during scheduled outages; (4) Monitoring of natural flow fluctuations will be conducted the first time flow conditions are appropriate and may occur as early as spring 2001; (5) Comparisons of project-induced ramping and natural flow fluctuations will be completed as soon as flow conditions permit.
TRIGGER EVENT: Biologically significant salmon and steelhead stranding or isolation, caused by project-induced ramping and natural flow fluctuations, is observed.
RESPONSE: Conduct a diagnostic assessment of ramping effects on anadromous salmonids at the 0.1 foot/hour rate specified in the MOU, or slower, that determines the relationship between stranding/ isolation and Ramping Rates using statistically valid techniques. The assessment would recommend a more appropriate Ramping Rate.
RESPONSE LIMITS: All instream flow changes for ramping deemed feasible, practical, reasonable, prudent, acceptable to the local community, and consistent with MOU and FERC protocols, will be implemented, provided that Consensus has been reached among the Parties. If Consensus has not been reached, then instream flow changes for ramping will be determined through the dispute resolution process.
RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: Ramping Rate is finalized base on diagnostic assessment Ramping Rate study or response evaluation.
REPORTING: Results from the Ramping Rate study will be incorporated into the annual Adaptive Management report. Other reporting and data management per standard data management and reporting procedures.
RESPONSIBILITY/FUNDING: (1) Resource Agencies will, subject to available funds, conduct and/or fund or seek funding for incidental monitoring and the diagnostic Ramping Rate assessment; (2) Licensee will fund, up to the Licensee's Commitment, costs associated with more restrictive Ramping Rates, consistent with WAF and AMF protocols.[21]
PASSAGE OBJECTIVE 1
Provide reliable upstream passage of salmon and steelhead adults at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams per contemporary engineering standards/guidelines.

[19] CDFG (2001) determined that 460 cfs is an adequate threshold flow below which ramping rates should be applied for the protection of salmon and steelhead downstream of Inskip Dam (and above which, ramping rates need not be applied) following the implementation of the Battle Creek Salmon and Steelhead Restoration Project.

[20] MOU Section 9.1A.2.(c)

[21] MOU Section 6.1.D and MOU Attachment 2

Table 6. Performance Measures (cont.)

HYPOTHESIS: Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will insure unimpeded passage of adult salmon and steelhead at fish ladders relative to contemporary standards/guidelines.
MONITORING AND DATA ASSESSMENT APPROACH: (1) Use video or electronic counters in ladders to count anadromous salmonids; (2) Compare ladder counts with spawner distribution and predicted habitat use; (3) In the course of other studies, look for direct evidence of fish injury related to upstream passage at fish ladders; (4) Study fish passage at each ladder with a group of tagged test fish and/or radio tracking; (5) Monitor the possible unintended downstream-return of upstream-migrating fish ("fall back") over or through diversion dams using tagged fish and/or radio tracking studies; (6) Make underwater observations for congregations of adults below the dam and compare to ladder counts; (7) Monitor key hydraulic parameters continuously for Fail-Safe capabilities according to long-term Operations and Maintenance Plan and Facility Monitoring Plan.
TIMELINE: (1) Monitor video or electronic counters for three years. Pursuant to adaptive management protocols, if salmon and steelhead populations are insufficient to affirm ladder effectiveness under continuous duty, then video or electronic counting will be continued for a longer period of time by agreement of the Parties to be determined per protocols; (2) Conduct continuous monitoring of key hydraulic parameters for the term of the AMP.
TRIGGER EVENT: (1) Standards/guidelines, or contemporary criteria, are changed and an evaluation of the existing ladder, according to contemporary testing protocol, demonstrates a significant exceedence from the standards/guidelines/criteria; (2) Operations and maintenance activities indicate that facilities are not performing as designed; (3) Contemporary standards/guidelines, or future criteria, are not met, and/or there is direct evidence of impaired fish passage;[22] (4) Direct evidence of salmon or steelhead injury from passage through fish ladders is observed; (5) Absence of spawning adults of species expected to distribute themselves in the higher elevation reaches of the stream, based on all observational data at times when there are sufficient populations of salmon and steelhead to observe, are observed for at least three years when no other barriers are identified.
RESPONSE: (1) If triggered by a change in standards/guidelines/criteria, refer matter to AMPT to determine response; (2) If triggered by a failure to perform as designed, then diagnose if there is direct evidence of impaired fish passage or injury; (3) If no direct evidence of impaired fish passage or injury, request a variance; (4) If triggered by unexpected spawner distribution (as defined in trigger event) then diagnose problem with appropriate tools such as tagged test fish or a radio tracking study; (5) If triggered by direct evidence of impaired fish passage or injury associated with fish ladders, then diagnose reason for the problem and modify or replace fish ladder or components.
RESPONSE LIMITS: All actions deemed feasible, practical, reasonable, prudent, acceptable to the local community, and consistent with MOU and FERC protocols, will be implemented, provided that Consensus has been reached among the Parties and dedicated funding is available. If Consensus has not been reached, then appropriate actions will be determined through the dispute resolution process. Major project changes in facilities (e.g., new dam site, dam removal, major facility changes) would be subject to the FERC decision-making process.
RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: Conclude ladder effectiveness monitoring after three years with sufficient salmon and steelhead populations and no identified fish passage problems at particular fish ladder. Continue operations and maintenance monitoring for the term of the AMP. Salmon and steelhead counts at the ladder may continue as needed for basin wide biological studies.
REPORTING: Per standard data management and reporting procedures.
RESPONSIBILITY/FUNDING: After transfer of facility from USBR to Licensee, Licensee assumes all

[22] Direct evidence of impaired fish passage could include, but is not limited to, persistent or repeated plugging of the ladder with debris or persistent, abnormally high concentrations of salmon and steelhead below dams combined with low ladder counts.

Table 6. Performance Measures (cont.)

costs for ladder repairs and replacements due to normal wear and tear, catastrophic damage, and any other type of damage, and will ensure that the ladders meet Fail-Safe criteria. Installation costs of new/additional facilities required to meet contemporary criteria or modification of existing facilities to avoid fish injury or mortality would be paid by Adaptive Management Fund protocols. However, in the event that the Adaptive Management Fund is exhausted, the Licensee will pay up to the Licensee's Commitment for Authorized Modifications to project facilities and operations which are determined to be necessary under adaptive management. The following responsibilities also apply after transfer of the facility from USBR to Licensee. (1) Licensee will conduct and/or fund, up to the Licensee's Commitment, monitoring to ensure the effectiveness and continued reliable operation of ladders pursuant to the Facilities Monitoring Plan; (2) Continued monitoring specified as part of the adaptive management process would be funded according to adaptive management protocols; (3) Resource Agencies will, subject to available funds, conduct and/or fund or seek funding for biological monitoring using ladder counts after the ladder is deemed effective.
PASSAGE OBJECTIVE 2
Provide reliable downstream passage of juveniles at North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams per contemporary criteria after the transfer of facilities to Licensee.
HYPOTHESIS: Implementation of facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that hydraulic parameters at fish screens meet contemporary criteria at all times.
MONITORING AND DATA ASSESSMENT APPROACH: (1) Use contemporary NMFS criteria[23] or subsequent NMFS approved criteria. As per p 73490 in NMFS "4d Rule"; (2) Biological effectiveness of the screen relies on meeting contemporary fish screen criteria as it has been affirmed to protect fish from injury and entrainment in applicable studies; (3) Measure, at various stream and diversion flows, hydraulic parameters such as approach and sweeping velocities, (4) Calculate flow rates for screen sections to verify approach and sweeping velocities; (5) Monitor key hydraulic parameters such as water surface elevation on both sides of fish screens continuously for Fail-Safe capabilities according to long-term Operations and Maintenance Plan and Facility Monitoring Plan; (6) Conduct visual observations of canals, during the course of other studies and especially at times when canals are dewatered, to check for possible entrainment.
TIMELINE: (1) Measure all relevant hydraulic parameters such as such as approach and sweeping velocities and water surface elevations at startup, and other appropriate times and flows as the facility ages, per the long-term Operations and Maintenance Plan; (2) Conduct continuous monitoring of water surface elevation on both sides of the fish screen for the term of the AMP.
TRIGGER EVENT: (1) Contemporary fish screen criteria is changed and an evaluation of the existing screen, according to contemporary testing protocol, demonstrates a significant exceedence from the criteria; (2) Operations and maintenance activities indicate that facilities are not performing as designed; (3) Contemporary criteria is not met, and/or there is evidence of fish entrainment or injury.
RESPONSE: (1) If triggered by a change in NMFS criteria, refer matter to AMPT to determine response; (2) If triggered by a failure to perform as designed, then diagnose whether facility provides injury-free downstream passage of juvenile salmon and steelhead; (3) If facility provides injury-free downstream passage of juvenile salmon and steelhead, request a variance; (4) If evidence of fish entrainment or injury, then diagnose reason for the problem and modify or replace fish screens or components.
RESPONSE LIMITS: All actions deemed feasible, practical, reasonable, prudent, acceptable to the local community, and consistent with MOU and FERC protocols, will be implemented, provided that Consensus has been reached among the Parties and dedicated funding is available. If Consensus has not been reached, then appropriate actions will be determined through the dispute resolution process. Major project changes in facilities (e.g., new dam site, dam removal, major facility changes) would be subject to the FERC decision-making process.

[23] For example, the contemporary fish screening criteria used to generate this plan were adopted from NMFS Southwest Region "Fish Screening Criteria For Anadromous Salmonids, January 1997."

Table 6. Performance Measures (cont.)

RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: None.
REPORTING: Per standard data management and reporting procedures
RESPONSIBILITY/FUNDING: The responsibility and funding of monitoring of key hydraulic parameters will be assigned in the Facilities Monitoring Plan. After transfer of facility from USBR to Licensee, Licensee assumes all costs for screen repairs and replacements due to normal wear and tear, catastrophic damage, and any other type of damage, and will ensure that the screens meet Fail-Safe criteria. Installation costs of new/additional facilities required to meet contemporary criteria or modification of existing facilities to avoid fish injury or mortality would be paid by Adaptive Management Fund protocols. However, in the event that the Adaptive Management Fund is exhausted, the Licensee will pay up to the Licensee's Commitment for Authorized Modifications to project facilities and operations which are determined to be necessary under adaptive management.
PASSAGE OBJECTIVE 3
Provide reliable upstream passage of adult salmon and steelhead to their appropriate habitat over natural obstacles within the Restoration Project area while maintaining an appropriate level of spatial separation among the runs.
HYPOTHESIS Implementation of instream flow levels and facilities modifications specified in the description of the Restoration Project, implementation of the Facilities Monitoring Plan, and implementation of any adaptive responses affecting instream flows or hydroelectric project facilities, will ensure that Natural instream barriers do not impede upstream migration of adult salmon and steelhead at prescribed flows and normal wet season flow regimes.
MONITORING AND DATA ASSESSMENT APPROACH: (1) Inspect potential barriers during annual surveys including photographic documentation and description; (2) Compare spawner distribution relative to suspected barriers; (3) Compare observed spawner distribution relative to expected spawner distribution for a particular species; (4) Use contemporary methodologies that consider flow regime to identify actual barriers;[24] and (5) Employ additional diagnostic studies as needed (e.g., radio tracking) if observed spawning differs relative to expected spawning distribution but no specific barrier is identified.
TIMELINE: Conduct continuous monitoring of natural potential barriers for the term of the AMP.
TRIGGER EVENT: An obstacle in the Restoration Project area is found to be unduly impeding adult salmon or steelhead migration under a range of flows including the prescribed instream flows.
RESPONSE: (1) Modify barrier, giving priority to those barriers that block large portions of a species' preferred habitat, while maintaining an appropriate level of spatial separation among the runs;[25] (2) If barrier cannot be modified either in the short term or long term, acquire water to change instream flows, if appropriate, to levels that allow passage over natural barriers for the necessary times only.
RESPONSE LIMITS: All instream flow changes for salmon and steelhead passage deemed feasible, practical, reasonable, prudent, acceptable to the local community, and that are consistent with MOU and FERC protocols, will be implemented, provided that Consensus has been reached among the Parties. If Consensus has not been reached, then instream flow increases for salmon and steelhead passage will be

[24] For example, TRPA (1989) methodologies for barrier determination were used to generate this plan.

[25] Natural barriers within streams can provide many important ecosystem functions including restricting the movement of introduced fishes, acting as selective factors in the natural evolution of species, and separating subpopulations of native fishes. For example, sympatric races of chinook salmon generally segregate themselves by spawning at different times or in different locations within a stream. This spatial segregation is usually determined through interactions between flow and natural barriers. Removing some barriers could disrupt the natural factors controlling this natural segregation. For example, the spawning timing of spring-run chinook and fall-run chinook may overlap. However, spring-run typically migrate to spawning grounds at higher flows and may more easily pass obstacles at those flows. Spring-run chinook could be put in unnatural contact with fall-run chinook if barriers were removed which normally stop fall-run during the low flow season. Because of the many benefits of natural barriers, caution and careful analysis will characterize any decisions to remove natural barriers under Adaptive Management.

Table 6. Performance Measures (cont.)

determined through the dispute resolution process. If appropriate level of barrier modification is not feasible, then flow changes would be set to levels that allow passage over natural barriers for the necessary times only. Long-term and medium-term instream flow increases over the estimated flows for maximum usable habitat will provide not less than 90 percent of the maximum usable habitat. Short-term, pulsed instream flows may be set to higher levels that provide less than 90 percent of the maximum useable habitat for short periods of time.
RESPONSE EVALUATION: Per standard response evaluation described above.
END POINT: None
REPORTING: Per standard data management and reporting procedures.
RESPONSIBILITY/FUNDING: (1) Resource Agencies will, subject to available funds, conduct and/or fund or seek funding sources other than the Licensee for monitoring activities; (2) Resource Agencies will, subject to available funds, conduct and/or fund or seek funding sources other than the AMF or the Licensee for modification of barriers; (3) Water acquisition for increased instream flows downstream of Inskip, North Battle Creek Feeder, and Eagle Canyon diversion dams to facilitate fish passage will be funded by the WAF, AMF, Licensee up to the Licensee's Commitment, and/or others.

6. Data handling and Storage –

It will be the responsibility of any Party collecting and/or funding the collection of data as part of Adaptive Management monitoring to ensure that the following data management protocols are carried out. All data collected as part of Adaptive Management monitoring will be:

- Collected according to scientifically sound protocols developed by the agencies collecting or funding data collection;
- Collected following AMP protocols for data collection on private lands;
- Validated using scientifically sound quality assurance and quality control procedures before being released to the public or other agencies, or used in decision making;
- Include information consistent with CMARP, EPA, or other contemporary standards;
- Stored and/or disseminated in an appropriate agency information system that is publicly accessible which provides for public distribution of information; and
- Transmitted to the BCWC for storage and/or dissemination in an information system operated and maintained by the BCWC and will include metadata and narrative descriptions of the goals, objectives, methodology of data collection, and a description of the limitations on the use of the data.

Contemporary CMARP and EPA data collection standards encourage the collection of the following information: date; time; station code; GPS (global positioning system) coordinates; species; length; length criteria; marks or tags; life stage; plus count; live/dead; effort information; trapping efficiency; basic water quality data such as temperature, turbidity, flow; and metadata. Adaptive Management data collection and storage standards may change to meet any changes in contemporary standards.

7. Expected Products/Outcomes –

Ultimately, the expected outcome of the proposed Restoration Project is restoration of populations of listed chinook salmon species and steelhead. The principle product includes the completion of the physical features of the proposed Restoration Project. Associated documents to be prepared include:

- As-Built drawings of all physical structures.
- Construction Monitoring Documentation
- Designer's Operating Criteria Report
- Design Summary Report
- Facilities Monitoring Plan
- EIS/EIR
- Adaptive Management Plan
- Adaptive Management Monitoring Documentation (developed separately under other programs)

8. Work Schedule –

Table 7 shows the general work schedule for completing construction activities associated with the proposed Restoration Project. Construction sequencing and delineation of construction specifications is governed by three main assumptions:

- Sequence construction to minimize power outages
- Sequence construction to attain benefits to aquatic resources as early as possible and to minimize adverse impacts associated with construction
- Sequence construction to minimize streamflow diversion requirements at each damsite during dam removal and for other instream construction.

Table 7. Proposed Work Schedule

Task	Estimated Start Date	Estimated Finish Date
Task 1: Facility Construction		
Specification 1: Hydropower Facilities Contract All facilities at Inskip Diversion Dam/South Powerhouse (including fish and ladder) and at Coleman Diversion Dam/Inskip Powerhouse (including Coleman Diversion Dam Removal); Dam removals on Soap and Ripley Creeks	July 2002	November 2004
Specification 2: Wildcat Diversion Dam Removal	July 2002	November 2002
Specification 3: North Fork Dams - Fish Screens and Ladders	October 2002	October 2003
Specification 4: South Diversion Dam Removal	May 2004	September 2004
Task 2: Construction Administration/Project Management	July 2002	June 2005

B. Applicability to CALFED ERP and Science program Goals and Implementation Plan and CVPIA Priorities

1. ERP, Science Program and CVPIA Priorities –

Strategic goals identified in the "Ecosystem Restoration Program Draft Stage 1 Implementation Plan – August 2001" which apply to the proposed Restoration Project include:

- Goal 1 – At-Risk Species
- Goal 2 – Ecosystem Processes and Biotic Communities
- Goal 4 – Habitats

Restoration priorities for the Sacramento Region identified in the Draft Stage 1 Implementation Plan which apply to the Restoration Project include

- Develop and implement habitat management and restoration actions in collaboration with local groups
- Restore fish habitat and fish passage particularly for spring-run chinook salmon and steelhead trout and conduct passage studies
- Conduct adaptive management experiments in regard to natural and modified flow regimes to promote ecosystem functions of otherwise support restoration actions
- Develop conceptual models to support restoration of river, stream, and riparian habitat.

Table 8 provides a more detailed discussion of how the proposed Restoration Project meets the goals of the CALFED Ecosystem Restoration Program.

The CVPIA Anadromous Fish Restoration Program (AFRP) has identified 12 actions that would help restore anadromous fish to Battle Creek, including increasing instream flows past PG&E's hydropower diversions and installing effective fish screens and ladders. Of the twelve proposed actions listed in the AFRP, three are elements of the proposed Restoration Project.

2. Relationship to Other Ecosystem Restoration Projects -

Table 9 delineates a list of other ongoing projects in the Battle Creek watershed. Additional projects are also be carried out by the local watershed Conservancy and the California Department of Fish and Game. A detailed discussion of many of these other programs or projects is found in the Draft Adaptive Management Plan (Ward, 2001).

3. Requests for Next-Phase Funding –

While not specifically requesting next phase funding, this proposal does request supplemental funding to complete construction on all proposed features of the Restoration Project. Attachment 1 provides a status/progress report on the Restoration Project funded under Project No. 1999-B01.

4. Previous Recipients of CALFED Program or CVPIA funding –

The Restoration Project was initially funded under CALFED Project No. 1999-B01 ($28 million). This proposal requests supplemental funding to complete construction of all features associated with the Project funded under this earlier agreement.

Two previous interim flow agreements with PG&E Company for augmenting flows on Battle Creek have previously been funded under the CVPIA water acquisition program. The first agreement with PG&E Company was dated October 4, 1996 (Contract No. 6-07-20-W1379) and was affective until November 1998. The second agreement was dated November 17, 1998 (Contract No. 8-07-20-W1528) and expired in February 2001.

Table 8. Relationship of the Restoration Project to ERP Visions

Element	ERP Vision	Achievement Method
Central Valley Streamflows	The ERP vision for Central Valley streamflows is to protect and enhance the ecological functions that are achieved through the physical and biological processes that operate within the stream channel and associated riparian and floodplain areas in order to contribute to the recovery of species and the overall health of the Bay-Delta.	The Restoration Project will substantially increase stream flows to meet the needs of ERP priority 1 fish species, chinook salmon and steelhead. The AMP contains protocols for changing these stream flows if necessary to increase chinook salmon and steelhead populations, chinook salmon and steelhead habitat, or assist chinook salmon and steelhead passage.
Stream Meander	The ERP vision for stream meander is to conserve and reestablish areas of active stream meander, where feasible, by implementing stream conservation programs, setting levees back, and reestablishing natural sediment supply to restore riverine and floodplain habitats for fish, wildlife, and plant communities.	By removing several diversion dams from Battle Creek, the Restoration Project will aid in the reestablishment of active stream meanders to the extent that Battle Creek and its tributaries meander naturally. Furthermore, agreements between Licensee and CDFG regarding enhancing the natural sediment supply and sediment routing in Battle Creek have been formalized in the past and will be pursued in the future.
Natural Floodplains and Flood Processes	The ERP vision for natural floodplains and flood processes is to conserve existing and intact floodplains and modify or remove barriers to over-bank flooding to reestablish aquatic, wetland, and riparian floodplain habitats.	By removing several diversion dams from Battle Creek, the Restoration Project will aid in the reestablishment of natural floodplains and flood processes, even though the FERC Project No. 1121 has historically had a relatively minor affect on natural flood flows.
Coarse Sediment Supply	The ERP vision for coarse sediment supply is to provide a sustained supply of alluvial sediments that are transported by rivers and streams and distributed to river bed deposits, floodplains, channel bars, riffles, shallow shoals, and mudflats, throughout the Sacramento-San Joaquin Valley, Delta, and Bay regions. This would contribute to habitat structure, function, and foodweb production throughout the ecosystem.	By removing several diversion dams from Battle Creek, the Restoration Project will prevent the loss of naturally-supplied sediment that can be stored in reservoir impoundments or removed from the system by reservoir dredging operations.

Table 8. Relationship of the Restoration Project to ERP Vision cont.)

Element	ERP Vision	Achievement Method
Central Valley Stream Temperatures	The ERP vision for Central Valley stream temperatures is to restore natural seasonal patterns of water temperature in streams, rivers, and the Delta to benefit aquatic species by protecting and improving ecological processes that regulate water	The Restoration Project will substantially increase instream flows, increase spring releases from hydroelectric project water collection facilities, and remove interbasin transfers of water to restore natural seasonal patterns of water temperatures in Battle Creek by protecting and improving ecological processes that regulate water. Furthermore, the AMP contains protocols for changing these stream flows if necessary to meet appropriate water temperature criteria.
Riparian and Riverine Aquatic Habitats	The ERP vision for riparian and riverine aquatic habitats is to increase their area and protect and improve their quality. Achieving this vision will assist in the recovery of special-status fish and wildlife populations and provide high-quality habitat for other fish and wildlife dependent on the Bay-Delta. The ERP vision includes restoring native riparian communities ranging from valley oak woodland associated with higher, less frequently inundated floodplain elevations to willow scrub associated with low, frequently inundated floodplain elevation sites such as stream banks, point bars, and in-channel bars.	By removing several diversion dams from Battle Creek, increasing instream flows, and increasing cold-water spring releases from hydroelectric project water collection facilities, the Restoration Project will improve riparian and riverine aquatic habitats. It is believed that higher instream flows will aid in the distribution of seeds from riparian plant species and elevate the dry-season water table in the riparian area fostering an expansion of riparian communities such as willow scrub.
Freshwater Fish Habitats	The ERP vision for freshwater fish habitats is to protect existing habitat from degradation or loss, to restore degraded habitats, and restore areas to a more natural state. Freshwater fish habitat will be increased to assist in the recovery of special-status plant, fish, and wildlife populations. Restoration will provide high-quality habitat for other fish and wildlife dependent on the Bay-Delta.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore degraded freshwater fish habitats to assist in the recovery of special-status plant, fish, and wildlife populations.
Essential Fish Habitats	The ERP vision for essential fish habitats is to maintain and improve the quality of existing habitats and to restore former habitats in order to support self-sustaining populations of chinook salmon.	By removing several diversion dams from Battle Creek, increasing instream flows, increasing cold water spring releases from hydroelectric project water collection facilities, and providing improved fish passage facilities, the Restoration Project will restore degraded freshwater fish habitats to assist in the recovery of self-sustaining populations of four races of chinook salmon.

Table 8. Relationship of the Restoration Project to ERP Vision cont.)

Element	ERP Vision	Achievement Method
Winter-Run Chinook Salmon	The ERP vision for winter-run chinook salmon is to recover this State and Federally-listed endangered species, achieve naturally spawning population levels that support and maintain ocean commercial and ocean and inland recreational fisheries, and that fully uses existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley.	By removing several diversion dams from Battle Creek, increasing instream flows, increasing flows from cold water springs, and providing improved fish passage facilities, the Restoration Project will restore degraded freshwater fish habitats to assist in the recovery of self-sustaining populations of winter-run chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in large part based on the needs of winter-run chinook salmon. Furthermore, the AMP contains protocols for changing these stream flows if necessary to specifically meet the habitat needs of winter-run chinook salmon.
Spring-Run Chinook Salmon	The ERP vision for spring-run chinook salmon is to recover this State and Federally-listed threatened species under the ESA, achieve naturally spawning population levels that support and maintain ocean commercial and ocean and inland recreational fisheries, and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley.	By removing several diversion dams from Battle Creek, increasing instream flows, increasing flows from cold water springs, and providing improved fish passage facilities, the Restoration Project will restore degraded freshwater fish habitats to assist in the recovery of self-sustaining populations of spring-run chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in large part based on the needs of spring-run chinook salmon. Furthermore, the AMP contains protocols for changing these stream flows if necessary to specifically meet the habitat needs of spring-run chinook salmon.
Late-Fall-Run Chinook Salmon	The ERP vision for late-fall-run chinook salmon is to recover this stock which is presently a candidate for listing under the ESA (it is included in the fall-run chinook salmon evolutionarily significant unit), achieve naturally spawning population levels that support and maintain ocean commercial and ocean and inland recreational fisheries, and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore degraded freshwater fish habitats to assist in the recovery of self-sustaining populations of late-fall-run chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in large part based on the needs of late-fall-run chinook salmon. Furthermore, the AMP contains protocols for changing these stream flows if necessary to specifically meet the habitat needs of late-fall-run chinook salmon.

Table 8. Relationship of the Restoration Project to ERP Vision cont.)

Element	ERP Vision	Achievement Method
Fall-Run Chinook Salmon	The ERP vision for the fall-run chinook salmon evolutionarily significant unit is to recover all stocks presently a candidate for listing under the ESA achieve naturally spawning population levels that support and maintain ocean commercial and ocean and inland recreational fisheries, and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore degraded freshwater fish habitats to assist in the recovery of self-sustaining populations of fall-run chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in consideration of the needs of fall-run chinook salmon. Furthermore, the AMP contains protocols for changing these stream flows if necessary to specifically meet the habitat needs of fall-run chinook salmon.
Steelhead Trout	The ERP vision for Central Valley steelhead trout is to recover this species listed as threatened under the ESA and achieve naturally spawning populations of sufficient size to support inland recreational fishing and that fully uses existing and restored habitat areas.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore degraded freshwater fish habitats to assist in the recovery of self-sustaining populations of steelhead. Fish passage facilities and prescribed minimum instream flows were determined in large part based on the needs of steelhead. Furthermore, the AMP contains protocols for changing these stream flows if necessary to specifically meet the habitat needs of steelhead.
Anadromous Lampreys	The ERP vision for anadromous lampreys is to maintain and restore population distribution and abundance to higher levels than at present. The ERP vision is also to better understand life history and identify factors which influence abundance. Better knowledge of these species and restoration would ensure their long-term population sustainability.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore degraded freshwater fish habitats to assist in the recovery of self-sustaining populations of anadromous lamprey. Furthermore, monitoring approaches within the AMP will contribute to gaining a better understanding of the life history identify factors which influence the abundance of anadromous lamprey.
Native Resident Fish Species	The ERP vision for resident fish species is to maintain and restore the distribution and abundance of native species, such as Sacramento blackfish, hardhead, and tule perch to contribute to the overall species richness and diversity. Achieving this vision will reduce conflict between protection for this species and other beneficial uses of land and water in the Bay-Delta.	By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore degraded freshwater fish habitats and should assist the restoration of the distribution and abundance of native fish species in Battle Creek.

Table 9. Other CALFED Projects in the Battle Creek Watershed

PROJECTS ON BATTLE CREEK			
Program/Number	**Project Title**	**Amount**	**Status**
CALFED/96-M12	Salmon and Steelhead Restoration Study	306,000	Project Completed
CALFED/96-M25	Establish Watershed Conservancy	50,000	90% complete
CALFED/97-M02	Screens and Fish Passage	395,000	Work in progress
CALFED/98-B16	Screens and Fish Passage	395,000	Work in progress
CALFED/98-C14	Monitoring in Battle Creek	150,000	Work in progress
CALFED/98-E06	Battle Creek Watershed Stewardship	145,000	Additional funding provided by AFRP
CALFED/99-B01	Battle Creek Restoration Project	28,000,000	Work in progress
CALFED/99-B08	Improve Upstream Ladder and Barrier Weir at Hatchery	2,500,000	Work in progress
CALFED/99-B12	Riparian Corridor Acquisition and Restoration - Bloody Island	2,240,250	Planning and designing restoration
CALFED/01-N45	Battle Creek Monitoring Projects	1,576,152	Contract in development
CVPIA/AFRP	Hatchery Management Alternatives Analysis (integrate CNFH operations with restoration of naturally produced salmonids populations).	69,578	Work in progress
CVPIA/AFRP	Conservation Easement: Eagle Canyon area	421,700	Project nearing completion
CVPIA/AFRP	Community-based plan for restoration and preservation of the Battle Creek watershed	63,985	Project nearing completion
CVPIA/AFRP	Environmental Education	28,733	Work in progress
CVPIA/AFRP	Continue to develop a long-term solution for screening CNFH water intakes	301,174	Report completed
CVPIA/AFRP	Survey and monitor adult winter and spring-run chinook salmon on Battle Creek	80,000	Project Completed
CVPIA/AFRP	Battle Creek Watershed Stewardship, Phase II	268,817	Agreement in place
CVPIA/AFRP	Genetic analysis of winter-run chinook salmon (Sacramento River project)	900,000	Work in progress
CVPIA Water Acquisition (b)(3)	Increase flows in Battle Creek by decreasing hydropower diversions.	1,835,000	Underway.

Table 9. Other CALFED Projects in the Battle Creek Watershed (cont.)

CVPIA Coleman NFH (b)(11)	Competitive Interaction Study (Sacramento River)		Work underway.
CVPIA Coleman NFH (b)(11)	Assist P.G.&E. with constructing a picket weir on the Coleman Powerhouse Tailrace.	$210,000	Known that this is USBR money, unknown if this is CVPIA money.
CVPIA Coleman NFH (b)(11)	Ozone Water Treatment Facility	$13,000,000	Project completed.
CVPIA Coleman NFH (b)(11)	Ozone efficacy assessment (tagging fall chinook).	$0	Underway.
CVPIA CAMP (b)(16)	Juvenile salmonid monitoring 1998-2001	$489,000	Funds shown reflect the amount allocated.

Environmental compliance for this agreement was completed in September 1998 and documented in the "Final Environmental Assessment for Temporary Reduction in Water Diversions from Battle Creek." Additional CALFED funding has recently been approved to extend this interim flow agreement until the long-term Restoration Project has been completed. This flow augmentation proposal will transition flow regimes from the minimal FERC mandated flows as established in the existing hydropower project license (FERC License No. 1121) to those flow regimes ultimately established under the long-term Restoration Project.

5. System-wide Ecosystem Benefits –

The local Battle Creek Watershed Conservancy is currently carrying out watershed studies for the Battle Creek Watershed. This work includes the development of watershed management strategies. This work is examining, among other things, land use practices that may ultimately affect fishery restoration projects in the watershed. These Independent Efforts by the local Conservancy will facilitate successful implementation of this Restoration Project.

6. Additional Information for Proposals Containing Land Acquisition –

Most access to be carried out for implementing the proposed Restoration Project is being obtained in cooperation with PG&E Company. Where sufficient existing PG&E Company rights-of-way are being used for implementing this project. Specific agreements with individual landowners may also be needed. Construction agreements will be worked jointly by PG&E Company and Reclamation with individual landowners as necessary. The existing MOU between PG&E Company and the various agency representatives for the restoration Project contractually obligates PG&E Company in the role of land acquisition.

C. Qualifications

Key agency roles and personnel are described below. Individual biographical sketches can be provided upon request.

U.S. Bureau of Reclamation

Reclamation will be the lead agency to implement all facility removal and modification activities associated with the Restoration Project. This includes design data collection, permitting, environmental compliance, design, construction, and construction contract administration. All construction will be performed by construction contractors procured through a competitive bid process. A full compliment of staff from Reclamation's Denver Technical Service Center, the Mid-Pacific regional Office, the Northern California Area Office, and the Mid-Pacific Construction Office located in Willows will provide resources in the implementation of this project. Key Personnel include:

David W. Gore, Project Manager
Tom Hepler, Design Team Leader
Jim Goodwin, Design Team Leader
Mary Marshall, Environmental Coordinator
Richard Welsh, Project Construction Engineer
Barry Longwell, Construction Team Leader

U.S. Fish and Wildlife Service

The Fish and Wildlife Service has responsibilities associated with ESA consultation processes, development of environmental compliance documents, long-term monitoring, and participation in the development of the Adaptive Management Plan. Staffing from the Sacramento Ecological Services Office, the Sacramento Endangered Species Office, the Red Bluff Fisheries Office, and the Coleman National Fish Hatchery will participate at various stages in the implementation of the Restoration Project. Key personnel include:

Jim Smith, Chairman, Adaptive Management Policy Team
Bart Prose, Biologist, Ecological Services
Matt Brown, Biologist, Fishery Monitoring Program

National Marine Fisheries Service

NMFS has primary responsibility for ensuring ESA compliance. NMFS will also provide technical engineering support to ensure facilities are designed in a manner to fully meet all regulatory requirements. Key staff include:

John Johnson, Fish Structure Engineer
Mike Tucker, ESA Compliance

California Department of Water Resources

DWR has lead responsibility, under contract to Reclamation, for the designs of the screen and ladder facilities. Staffing from the Sacramento Division of Engineering and the Northern District will participate in the design of these features. Key personnel are:

Cosme D. Diaz, Program Manager
Lucas H. Munoz, Design Leader, Inskip Diversion Fish Screen and Ladder
Jeanne Schallberger, Design Leader, North Battle Creek Feeder Fish Screen and Ladder
Timothy J. Talbert, Design Leader, Eagle Canyon Fish Screen and Ladder

California Department of Fish and Game

CDFG has the lead responsibility for dedication of water rights associated with decommissioning of selected dam features. CDFG will also provide engineering technical support and peer review in the development of fish passage facilities. CDFG

also participates in the development of the Adaptive Management Plan. Staff support comes from Sacramento and northern California offices. Key personnel are:

Harry Rectenwald, Chairman, Adaptive Management Technical Team
Steve Turek, Project Management Team

State Water Resources Control Board

The State Water Resources Control Board is the State Lead Agency for CEQA compliance and for issuance of the CWA Section 401 Water Quality Certification. Key contact:

Jim Canaday, Environmental Specialist

Pacific Gas & Electric Company

As owner/operator of the Battle Creek Hydroelectric Project, PG&E Company has a full range of responsibilities in the implementation of this Restoration Project. PG&E Company has the lead responsibility in the FERC license amendment process. Key personnel include:

Jean Oscamou, Project Manager
Angela Risdon, Senior license Coordinator

Federal Energy Regulatory Commission

FERC is a cooperating agency with regard to the development of the EIS/EIR for the Restoration Project. FERC will make the determination on the request for a Battle Creek Hydroelectric Project license amendment. Key contact:

Thomas J. (TJ) LoVullo, Hydropower Team Leader

D. Cost

1. Budget –

The total request for funding under this proposal is $12,000,000. This additional funding is intended to supplement funding provided under earlier approved CALFED funding of this project.

2. Cost-Sharing –

A complete delineation of responsibilities of other agencies and PG&E Company for the Restoration Project Proposed Action is found in the June 1999 MOU.

E. Local Involvement

Members of the Battle Creek Watershed Conservancy (BCWC) and the Battle Creek Working Group (BCWG) meet monthly to discuss technical and policy issues relating to restoration in the watershed. Numerous working sessions have addressed upstream watershed concerns, hatchery and natural fish interaction, and other environmental and Endangered Species Act regulatory concerns and assurances. Compatibility of Coleman National Fish hatchery operations with Battle Creek watershed restoration is a major concern of stakeholders engaged in planning and implementing restoration activities in the Battle Creek watershed. Continued collaboration and partnering with stakeholders is critical to implementing restoration actions in the watershed.

F. Compliance with Standard Terms and Conditions

Reclamation takes exception to several of the standard terms and conditions outlined in Attachment D, however, will comply with applicable replacement terms negotiated with the Department of Water Resources and formalized in DWR 4247 (Rev. 9/95), Standard Clauses -- Contracts with the United States Bureau of Reclamation.

Reclamation further takes exception to Attachment D, Item 2. Payment Schedule and Item 3. Performance Retention, as it implies that payment for all work under the grant will be made on a reimbursable basis. Reclamation requires advances of funds in whole or part from non-Federal funding entities seeking services that do not fall within the rules and regulations promulgated in Office of Management and Budget Circular A-97.

G. Literature Cited

- Upper Sacramento River Fisheries and Riparian Habitat Management Plan (California Senate Bill 1086), 1989
- Central Valley Salmon and Steelhead Restoration and Enhancement Plan, California Department of Fish and Game, 1990
- California State Salmon, Steelhead Trout, and Anadromous Fisheries Program Act (California Senate Bill 2261), 1990
- Steelhead Restoration Plan and Management Plan for California, California Department of Fish and Game, 1990
- Central Valley Project Improvement Act Anadromous Fish Restoration Program (Title 34 of Public Law 102-5750, 1992
- CALFED California Bay-Delta Ecological Restoration Program
- Restoring Central Valley Streams – A Plan for Action, California Department of Fish and Game, 1993
- Actions to Restore Central Valley Spring-Run Chinook Salmon, California Department of Fish and Game, 1996
- National Marine Fisheries Service Proposed Recovery Plan for Sacramento River Winter-Run Chinook Salmon, National Marine Fisheries Service, 1997
- U.S. Fish and Wildlife Service Draft Central Valley Anadromous Fish Restoration Plan, 1997 (final in 2001)

- California Department of Fish and Game Status Review for Spring Run Chinook Salmon in the Sacramento River, 1998
- Battle Creek Salmon and Steelhead Restoration Plan – January 1999, prepared for the Battle Creek Working Group by Kier Associates.
- Memorandum of Understanding by and Among National Marine Fisheries Service, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, California Department of Fish and Game, and Pacific Gas & Electric Company, June 1999
- Ecosystem Restoration Program Draft Stage 1 Implementation Plan, CALFED Bay-Delta Program, August 2001
- SNTEMP Stream Temperature Model -1998c, 1998d, 1996a, 1996b, T.R. Payne and Associates (TRPA)
- Stream Temperature Model for the Battle Creek Salmon and Steelhead Restoration Project – Report No. 026.11-00.256 – Pacific Gas and Electric Company Technical and Ecological Services, January 2001, Dr. Scott Tu
- Surveys of Barriers to the Upstream Migration of Anadromous Salmonids – Battle Creek Fisheries Studies, June 10, 1998, prepared for the California Department of Fish and Game by Thomas R. Payne and Associates
- Draft Battle Creek salmon and Steelhead Restoration Project Adaptive Management Plan – March 2001, prepared for the U.S. Bureau of Reclamation by Kier Associates (Michael B. Ward)
- Healey, M. 2001. Draft comments on the Battle Creek Adaptive Management Plan. CALFED Independent Science Board. Sacramento, CA. 8 pp.

ATTACHMENT 1
Battle Creek Salmon and Steelhead Restoration Project
Status Report – September 2001

Expenditures to date are shown in Table 1. Table 2 shows the current proposed schedule for completion of this project. Table 3 shows the current status of funding and anticipated costs. Below is a general description of the status, funding, and implementation issues.

To date, conceptual design work has been completed for all alternatives and more refined designs on the proposed action have been initiated. Design coordination continues with the environmental compliance team. Biological surveys have been done and are scheduled as necessary to maintain a continuous assessment of the presence of various species. Permitting actions have been initiated. The EIS/EIS is undergoing preparation.

Currently four construction specifications are to be awarded for the implementation of this project. These four specifications are:

- Specification 1: All facilities at Inskip Diversion Dam/South Powerhouse, Coleman Diversion Dam/Inskip Powerhouse, Soap Creek, and Lower Ripley Creek
- Specification 2: Wildcat Dam Removal
- Specification 3: All facilities at Eagle Canyon Dam and North Battle Creek feeder Dam
- Specification 4: South Diversion Dam Removal

Table 1. Expenditures to Date

Fiscal Year	Engineering	Environmental	Project Management	Total
1999	$419,373.96	$36,199.15	$27,113.77	$482,686.88
2000	$1,407,109.63	$413,143.15	$231,391.06	$2,051,643.84
2001	$1,303,028.16	$478,157.10	$256,085.01	$2,037,270.27
Total	**$3,129,511.75**	**$927,499.40**	**$514,589.84**	**$4,571,600.99**

Table 2. Current Schedule

Date	Environmental Compliance / FERC Licensing Process	Engineering Design/Construction
Oct. 30, 2001	Release of NEPA/CEQA Administrative Draft EIS/EIR	
Nov. 19, 2001		Transmit Draft Specification 1 for Review[26]
Nov. 20, 2001	Complete Administrative Draft Review	
Dec. 3, 2001		Transmit Draft Specification 2 for Review
Dec. 14, 2001	Complete Preparation of Draft EIS/EIR	
Dec. 19, 2001	Issue Public Draft EIS/EIR	
Jan. 4, 2002		Complete Review Draft Specifications 1 and 2
Jan. 7-16, 2002		Specification 1 Review Conference
Jan. 21-24, 2002		Specification 2 Review Conference
Jan. 30, 2002	Public Hearing	
Feb. 20, 2002	Complete EIS/EIR Public Review Period	
Mar. 1, 2002		Complete Preparation of Final Specifications 1 and 2
Mar. 29, 2002	Complete Incorporation of Comments/Preparation of Final EIS/EIR	Transmit Draft Specifications 3 and 4 for Review
Apr. 12, 2002	Complete Signatory Process and Final EIS/EIR Filings and Notices	Complete Review Draft Specifications 3 and 4
Apr. 15-30, 2002		Review Conference Specifications 3 and 4
May 12, 2002	Complete Final EIS/EIR No Action Period	
May 17, 2002	CEQA Findings/Notices, NEPA Record of Decision	
May 24, 2002	Issuance of 401 Water Quality Certification	
May 31, 2002	401 Certification Filed with FERC	
June 1, 2002		Complete Final Specifications 3 and 4
June 21, 2002	FERC Determination	
July 1, 2002		Award Specifications 1 and 2
Sept. 1, 2002		Award Specification 3 and 4[27]

[26] Specification 1: All facilities at Inskip Diversion Dam/South Powerhouse, Coleman Diversion Dam/Inskip Powerhouse, Soap Creek, and Lower Ripley Creek
Specification 2: Wildcat Dam Removal
Specification 3: All facilities at Eagle Canyon Diversion and North battle Creek Feeder Diversion
Specification 4: South Diversion Dam Removal

[27] Specification 3 must be awarded no later than February 2003 to allow minimally sufficient time for fabrication of screens for installation during low flow period in 2003. Specification 4 must be awarded no later than May 2004 to allow completion of instream removal work during low flow period of 2004.

Table 3. Funding Status and Anticipated Needs

Task Under Original February 1999 CALFED Proposal	Funding Allocations Under Original February 1999 CALFED Proposal	Current Anticipated Costs	Difference (Original Allocation – Current Anticipated Cost)	Comments
Task 1 – Wildcat Diversion Dam				
Wildcat Diversion Dam Removal	$2,740,000	$1,694,800	$1,045,200	Further refinements in design resulted in reduction of reconnaissance level cost estimates used as a basis for original proposal.
Task 2 – Eagle Canyon Diversion Dam				
Fish Screen	$1,950,000	$2293,100	-$2,112,500	Reconnaissance level design efforts that provided the basis for the original cost proposal assumed standard design criteria. Based on MOU commitments calling for high reliability screens and ladders a reassessment of design criteria was made for ladder designs. Modified flow criteria for ladder design resulted from this assessment, thereby resulting in increased costs. Refinements in the design of the screen led to cost increases in that feature. Constructability issues related to extremely difficult access were further refined in later designs.
Fish Ladder		$1,769,400		
Task 3 – North Battle Creek Diversion				
Fish Screen	$1,100,000	$1,568,200	-$1,415,800	Reconnaissance level design efforts that provided the basis for the original cost proposal assumed standard design
Fish Ladder		$489,000		

Table 3. Funding Status and Anticipated Needs

Task Under Original February 1999 CALFED Proposal	Funding Allocations Under Original February 1999 CALFED Proposal	Current Anticipated Costs	Difference (Original Allocation – Current Anticipated Cost)	Comments
Access Road and Footbridge	0	$458,600		criteria. Based on MOU commitments calling for high reliability screens and ladders a reassessment of design criteria was made for ladder designs. Modified flow criteria for ladder design resulted from this assessment, thereby resulting in increased costs. Refinements in the design of the screen led to cost increases in that feature. A change in concept also occurred related to access to this feature. Under original concept all construction was to occur via helicopter. Based on commitments for high reliability in the MOU, it was determined that an access road provides greater long-term reliability for carrying out operation and maintenance activities. Consequently, this feature was included.
Task 4 – South Diversion Dam				
South Dam Removal	$2,990,000	$2,716,100	$273,900	Revisions and refinements to reconnaissance level cost estimates led to cost savings.
Tasks 5A and 5B– Inskip Diversion Dam				
Task 5A – Fish Screen	$5,785,000	$3,022,500	-$6,740,100	Reconnaissance level design efforts that provided the basis for the original cost proposal assumed standard design criteria. Based on MOU commitments calling for high reliability screens and ladders a reassessment of design
Task 5A – South Powerhouse Bypass Tunnel and Tailrace Connector		$7,559,500		

Table 3. Funding Status and Anticipated Needs

Task Under Original February 1999 CALFED Proposal	Funding Allocations Under Original February 1999 CALFED Proposal	Current Anticipated Costs	Difference (Original Allocation – Current Anticipated Cost)	Comments
Task 5B – Fish Ladder		$1,943,100		criteria was made for ladder designs. Modified flow criteria for ladder design resulted from this assessment, thereby resulting in increased costs. Refinements in the design of the screen led to cost increases in that feature. Costs associated with incorporation of an access road at this site also contributed to higher costs. Refinement in design costs also resulted from further analysis of detailed design data.
Tasks 6A and 6B – Coleman Diversion Dam				
Task 6A – Tailrace Connector Inskip Powerhouse to Coleman Canal	$3,220,000	$1,601,600	$1,305,100	Cost savings achieved by further design revisions.
Task 6B – Coleman Dam Removal		$313,300		
Task 7 – Coleman Diversion Dam				
Inskip Powerhouse Bypass	$900,000	$5,589,000	-$4,689,000	At the time of the original proposal the nature of this proposed facility was in question because of the complexity of the facility. Eleven different alternatives means of achieving the goals of this bypass facility were evaluated. Complex engineering questions arose in the design of this structure. Extensive conceptual design effort went into determining the most feasible means of providing bypass capabilities while meeting biological and reliability goals. Significant hydraulic challenges arose in the design of this

Table 3. Funding Status and Anticipated Needs

Task Under Original February 1999 CALFED Proposal	Funding Allocations Under Original February 1999 CALFED Proposal	Current Anticipated Costs	Difference (Original Allocation – Current Anticipated Cost)	Comments
				feature.
Task 8 – Environmental Permitting and Monitoring	$2,020,000	$3,049,783	-$1,029,783	$1,000,000 of original allocation is dedicated to monitoring subsequent to completion of the project. Costs associated with preparation of the NEPA/CEQA document and permitting through a contractor are estimated at roughly $1,353,000. Additional costs are associated with post construction biological monitoring of mitigation implementation ($250,000). Other costs are associated with environmental coordination/project management, coordination with FERC in the license amendment process, cultural resources requirements, coordination with the Fish and Wildlife Service in the preparation in the Coordination Act Report, and coordination with NMFS in endangered species compliance.
Task 9 – Project Management	$1,116,000	$800,000	$316,000	Cost savings based on assessment of actual costs and projected effort required to complete. Task Items 1 through 8 above include engineering and design costs. In addition to the reasons for higher costs identified above, several factors have contributed to higher design costs. Extensive planning/conceptual level engineering work for the Inskip Powerhouse Bypass facility was required to determine the most appropriate means of meeting objectives for those facilities. Reconsideration of screen and ladder design criteria also required an engineering reevaluation of those facilities. Also, the collaborative team approach used throughout this project has required extensive coordination of design efforts and has led to consideration of multiple

Table 3. Funding Status and Anticipated Needs

Task Under Original February 1999 CALFED Proposal	Funding Allocations Under Original February 1999 CALFED Proposal	Current Anticipated Costs	Difference (Original Allocation – Current Anticipated Cost)	Comments
				design variations for various sub-features associated with each element. This has added time and effort to the engineering work.
Water Acquisition Fund	$3,000,000	$3,000,000	$0	
Cost of Forgone Power During Construction	$54,400	$54,400	$0	
Net Present Value of Forgone Power	$2,082,700	$2,082,700	$0	
Total	$26,958,100	$38,724,683	-$12,128,183	
Available CALFED Funding	$28,000,000			
Estimated Costs	$39,897,283			
Estimated Additional Funding Required	$11,897,283			
Additional Funding Requested	**$12,000,000**[28]			

[28] Note: Rounded to next higher million to account for remaining uncertainties in construction cost estimates and unknown site conditions potentially encountered during construction.