Appendix C

Adaptive Management Plan

The following is the Executive Summary of the Draft Adaptive Management Plan for the Battle Creek Salmon and Steelhead Restoration Project. For the full text of the Adaptive Management Plan, please visit the California Bay-Delta Authority's Ecosystem Restoration website at:

http://calwater.ca.gov/Programs/EcosystemRestoration/Ecosystem.shtml

and follow the links for Battle Creek.

DRAFT
BATTLE CREEK SALMON AND STEELHEAD RESTORATION PROJECT

ADAPTIVE MANAGEMENT PLAN

Prepared for the

U.S. Bureau of Reclamation

Pacific Gas and Electric Company

National Marine Fisheries Service

U.S. Fish and Wildlife Service

California Department of Fish and Game

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EXECUTIVE SUMMARY

The Battle Creek Salmon and Steelhead Restoration Project is a joint effort between PG&E, the National Marine Fisheries Service (NOAA Fisheries), California Department of Fish and Game (CDFG), U.S. Fish and Wildlife Service (USFWS), and U.S. Bureau of Reclamation (USBR) to restore salmon and steelhead runs in the Battle Creek watershed while maintaining the renewable energy production of the Battle Creek Hydroelectric Project (FERC Project No. 1121). A MOU was adopted in June 1999 stating the intent of the MOU Parties to engage in a restoration effort that would modify the facilities and operations of FERC Project No. 1121. The objectives of the Restoration Project are (1) the restoration of self-sustaining populations of Chinook salmon and steelhead and their habitat in the Battle Creek watershed, (2) up-front certainty regarding specific restoration components, (3) timely implementation and completion of restoration activities, and (4) joint development and implementation of a long-term AMP with dedicated funding sources to ensure the continued success of restoration efforts under this partnership.

The MOU identifies Adaptive Management as an important component of the Restoration Project (Figure 1). Adaptive Management uses extensive monitoring to identify problems, examine possible solutions for meeting the biological objectives, and if needed, allow changes to Contemporary strategies and actions within established limits to try to achieve the objectives and desired results. The Adaptive Management concept was formalized in this AMP developed by the PG&E, NOAA Fisheries, USFWS, and CDFG (collectively known herein as the "Parties"). Funding for implementation of the AMP is provided by the CALFED Monitoring Fund, the Water Acquisition Fund (WAF), the Adaptive Management Fund (AMF), and Licensee (PG&E).

The AMP provides guidance on implementing the Adaptive Management provisions of the MOU, and is intended to be consistent with the terms of the MOU. Any cases where the language in the AMP may conflict with the language in the MOU represent an oversight in the AMP. Therefore, the MOU prevails in any discrepancy that may be discovered between the AMP and the MOU.

The AMP was developed by Consensus between the Parties under the Adaptive Management Policy Team (AMPT) and the Adaptive Management Technical Team (AMTT). The AMPT consists of management-level representation from each of the Resource Agencies and the Licensee and is authorized to make all final decisions regarding the implementation of the AMP and to provide policy direction and dispute resolution on issues forwarded to it by the AMTT. The AMTT consists of technical experts from each of the Resource Agencies and the Licensee and is responsible for the development and implementation of the AMP portion of the Restoration Project when it has been approved by FERC. Definitions are provided in the AMP to minimize confusion and to simplify the text. Words or phrases defined in the AMP appear capitalized within this plan.

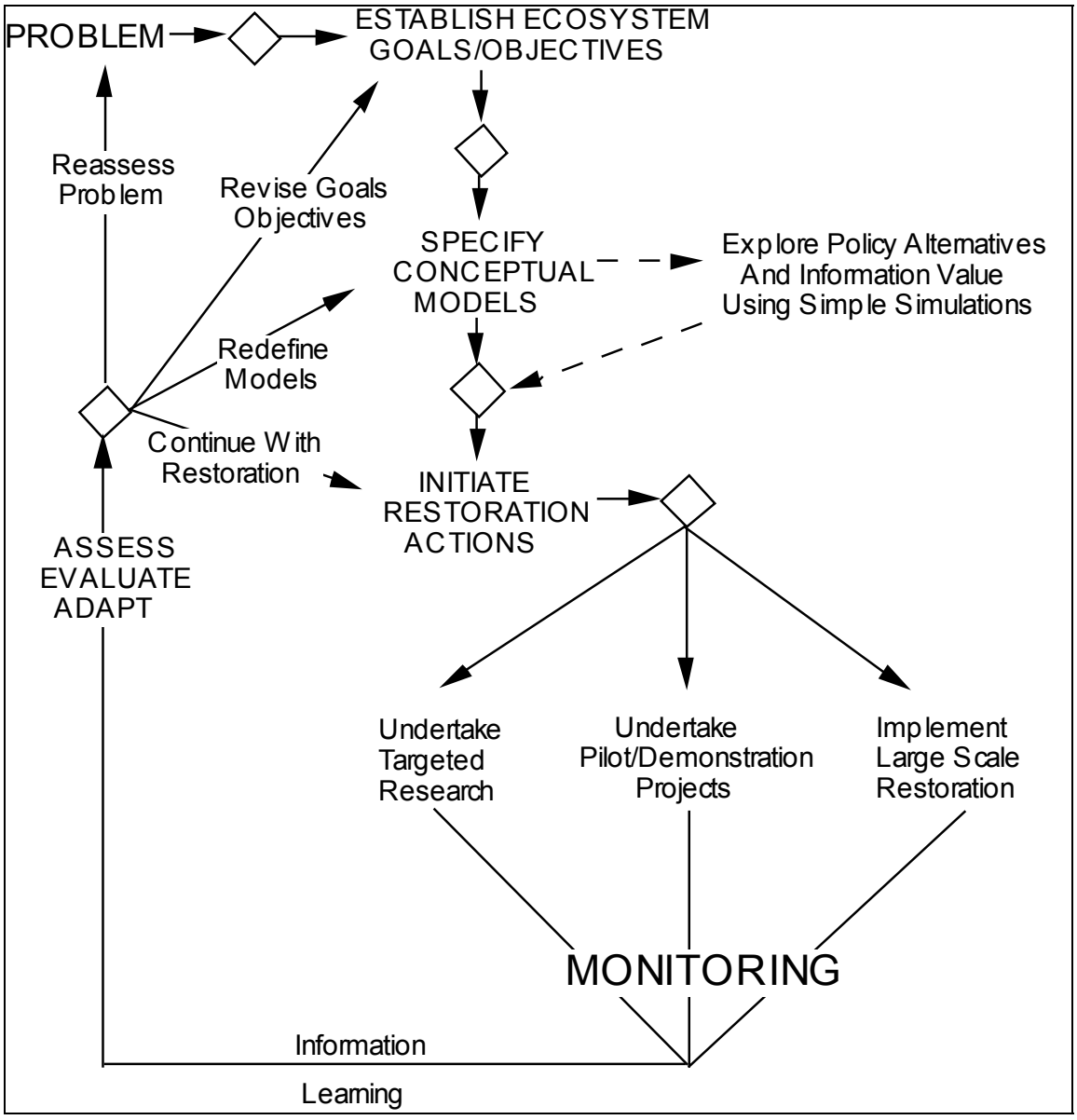

Figure 3. CALFED schematic of adaptive management.

Roles and responsibilities of the Parties pertaining to the AMP portion of the Restoration Project are listed in detail. The Licensee has agreed to a number of physical and operational changes and additions to FERC Project No. 1121 and has agreed to assume 90 percent of the initially forecast costs associated with the loss of power generation as well as other future costs. These include, but are not limited to, cost overruns for which the Licensee is responsible, future authorized facilities modifications or increased instream flows in the event the WAF and AMF are depleted, internal costs associated with providing expertise in the AMP process, and the loss

of power associated with meeting instream flow releases and Ramping Rate requirements. Upon completion of facility start-up and testing, Licensee is responsible for the operation, maintenance, replacement, and successful operation of all physical modifications to its facilities under the MOU. Licensee is also responsible for all facility and other monitoring required by the FERC license amendment for FERC Project No. 1121. NOAA Fisheries responsibilities are those it determines consistent with its mandate under the ESA. NOAA Fisheries also has the responsibility of defining recovery goals for salmon species listed under the ESA. Together the USFWS and CDFG agree to support the prescribed instream flows and Ramping Rates described in the MOU, or agreed upon through the Adaptive Management in the next relicensing proceeding for FERC Project No. 1121. USFWS and CDFG are also jointly responsible for conducting or funding a variety of monitoring, data collection and assessment, and report preparations associated with various fish population objectives. In addition, all Parties will be responsible for providing at least one representative to the AMPT and the AMTT and assuming all responsibilities and costs associated with these positions. All Parties will be individually responsible for any costs associated with their involvement in any FERC dispute resolution proceedings.

Sources of funding for the implementation of the AMP identified to date are the CALFED Monitoring Fund, the WAF, the AMF, and the Licensee. The CALFED Monitoring Fund of $1,000,000 is intended for monitoring costs associated with the Restoration Project. The WAF is a federal fund of $3,000,000 administered by the Resource Agencies per AMP protocols and intended for the sole purpose of acquiring additional instream flow releases in Battle Creek recommended under the AMP for a ten year period following the initial prescribed instream flow releases. The AMF of $3,000,000 is for the purpose of funding possible future changes to the Restoration Project developed under the AMP. The AMF is to be limited to actions under the Restoration Project directly associated with FERC Project No. 1121, and is expressly not available for funding of monitoring or construction cost overruns. In the event of the exhaustion or termination of the WAF, the AMF may be used to secure additional instream flow releases developed under the AMP. In the event of exhaustion of the WAF and AMF, the Licensee has committed up to a total of $6,000,000 for all Adaptive Management actions for Authorized Modifications to project facilities or flow operations which are determined to be necessary under Adaptive Management.

The AMP closely follows Contemporary theoretical and practical standards of adaptive management. Adaptive Management used in this plan includes elements of and, therefore, is a form of “active” adaptive management. However, because specific experimentation of instream flows and facilities modifications were not initially designed into the implementation of the AMP, the AMPT characterizes the restoration of Battle Creek as Passive Adaptive Management where changes in management are made in response to monitoring results.

The AMP bridges the theoretical and practical aspects of adaptive management by building a logical span between scientific knowledge and uncertainties, on the theoretical side, to monitoring activity schedules and budgets at the purely practical end. In between is a strong infrastructure of conceptual models and Adaptive Management Objectives.

The reader interested in skimming the essence of this AMP, that is to quickly view the bridge between adaptive management theory and practice as applied in Battle Creek, may wish to skip to the following AMP features:

- **Conceptual Models (Conceptual Models 1, 2, and 3) page 8**
- **Uncertainties Table (Table 3) page 12**
- **Adaptive Management Objectives (Section III.A) page 41**
- **Monitoring Activities (schedule and budget) (Table 24) page 84**

The Adaptive Management objectives outlined in the AMP focus on management of hydroelectric operations within the Restoration Project to facilitate habitat changes beneficial to salmon and steelhead. There is expected to be a corresponding increase in salmon and steelhead populations as a result of these management actions. Measuring such increases is practical for larger populations such as steelhead and fall-run Chinook salmon, but proving statistically significant responses to fish populations currently at extremely low levels, such as winter-run Chinook, may not be possible. Therefore, trigger events leading to Adaptive Management actions will not be based solely on populations data, but will also rely on measurements indicating habitat conditions. The AMP objectives do not include or exclude existing or potential future propagation or supplementation activities, nor do they include specific "active" experimentation of proposed instream flows or experimental changes to hydroelectric project facilities to elucidate relationships between management actions and ecological processes, nor do they address the possibility of future development within Battle Creek.

Although many anticipated limiting factors as well as many unanticipated circumstances have been outlined in the AMP, the plan acknowledges that not all events are predictable and, invariably, surprising circumstances will arise. However, it is the nature of Adaptive Management to design studies and management programs to adapt to unforeseen circumstances. Also, many unanticipated factors may be outside the scope of the Restoration Project. Just how an AMP responds to new circumstances is governed by a stepwise scientific process beginning with hypothesis testing of objectives through monitoring and data assessment. A timeline identifies the duration and order of monitoring activities and includes trigger events indicating that an Adaptive Management response is necessary. Adaptive Management responses would be evaluated to determine if the objective is being met and current actions should continue or if new actions are needed to meet the objectives. Adaptive Management responses could include any major or minor changes to the hydroelectric facility or the natural features of the Restoration Project. Responses to a trigger event will have limits identified by the FERC license amendment. Adaptive Management responses falling outside of those allowed by the FERC license amendment provisions would need to be addressed through established FERC processes. Key to the Adaptive Management process is a reporting regime consistent with the ability to design and evaluate responses to Adaptive Management actions.

The AMP objectives for the restoration of salmon and steelhead focus on improvements in population dynamics, improvements to the habitat, and improvements designed to ensure safe passage of adults and juveniles. The population objectives are (1) ensure successful salmon and

steelhead spawning and juvenile production, (2) restore and recover the assemblage of anadromous salmonids (i.e., winter-run Chinook, spring-run Chinook, steelhead) that inhabit the stream's cooler reaches during the dry season, (3) restore and recover the assemblage of anadromous salmonids (i.e., fall-run Chinook, late fall-run Chinook) that enter the stream as adults in the wet season and spawn upon arrival, and (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 the ecosystem carrying capacity. Objectives focusing on improving the habitat of salmon and steelhead are (1) maximize habitat quantity through changes in instream flow, (2) maximize habitat quantity by ensuring safe water temperatures, (3) minimize false attraction and harmful fluctuation in thermal and flow regimes resulting from planned outages or detectable leaks from the hydroelectric project, and (4) minimize the stranding and isolation of salmon and steelhead resulting from variations in flow regimes caused by hydroelectric project operations. Objectives for the safe and reliable passage of salmon and steelhead are (1) provide upstream passage of adults at dams, (2) provide downstream passage of juveniles at dams, and (3) provide upstream passage of adults to their appropriate habitat over natural obstacles while ensuring appropriate levels of spatial separation between runs.

To determine if the population objectives of the AMP are being met, assessments of population size, trends in productivity, population substructure, and population diversity must be compared to corresponding guidelines set forth by NOAA Fisheries. The AMP has adopted NOAA Fisheries definitions of "viable populations" as the intermediate population goal and identifies the maximization of salmon and steelhead production and full utilization of carrying capacity as the final goal. The fish passage objectives are intended to assist in restoring natural process of dispersal and the habitat objectives will work to restore natural ecological variation associated with the natural function of the ecosystem. Further threats to population diversity not covered by the AMP objectives will be addressed through the AMP "linkages."

The AMP is just one aspect of the Restoration Project and is closely linked with the other elements of the Restoration Project. Other programs within the Restoration Project cover some aspects of restoration not covered in the AMP such as facility operations and maintenance. The AMP is also linked to non-project restoration programs affecting salmon and steelhead populations both within and outside the Battle Creek watershed.

The implementation of the AMP is governed by a set of protocols. Adaptive Management activities on private land will be conducted in a manner that respects landowners' rights and privacy and that minimizes disturbances and risks to private lands. Protocols governing data management are consistent with guidelines established by Comprehensive Monitoring, Assessment, and Research Program (CMARP) and the Environmental Protection Agency (EPA). Data and information will be made available to the public by dissemination to the appropriate agency information storage systems and an information system operated and maintained by the BCWC.

Meetings of the AMTT will be scheduled four times per year including an annual meeting in March, when possible Adaptive Management actions will be considered. The AMPT will meet at least annually in late March. These March meetings of the AMTT and AMPT are scheduled to finalize annual reports in time for funding agency deadlines. Ad hoc meetings may be scheduled by the AMTT or AMPT to address emergencies without advanced public notice,

but such meetings will only consider the emergency at hand. All meetings will be open to the public, and all scheduled meetings will be announced to the public. Protocols also specify meeting announcement requirements, voting rules, report writing, Adaptive Management responses, proposal ranking, modification of Adaptive Management objectives, and dispute resolution.

Several Focused Studies were developed to address uncertainties and learning opportunities that may not be directly addressed by Adaptive Management objectives. These are listed in the final ten sections of the document.

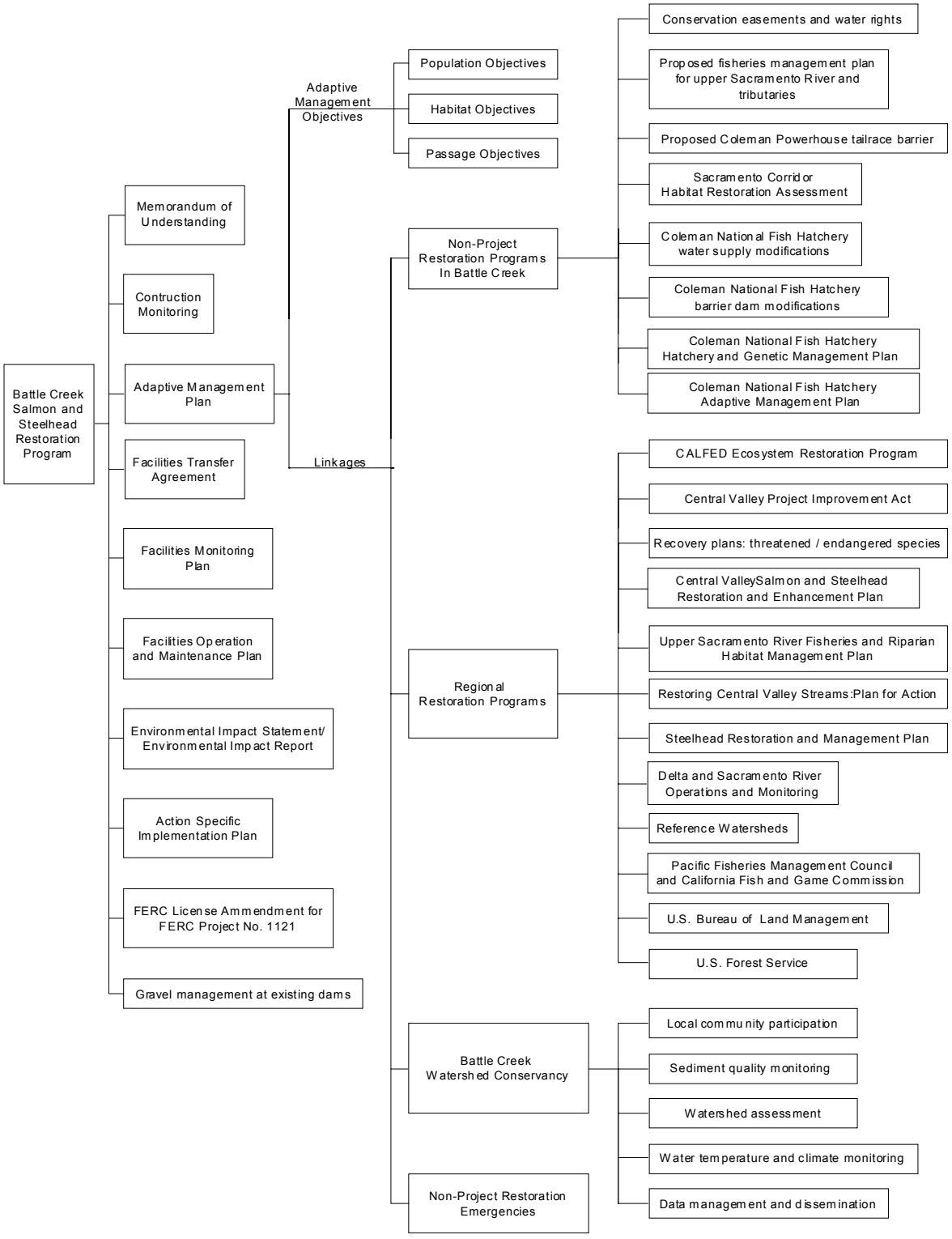

Figure 2. Schematic of the relationship of the AMP and Adaptive Management objectives with other Restoration Project and non-project restoration activities that may affect salmon and steelhead in Battle Creek.