Attachment - Study Plan Request

Mokelumne Pumped Storage Project (P-14796-001)

Study Request – Comprehensive & Cumulative Water Quality Impact Analysis on the Resource Management Operations in the Lower Mokelumne River

The currently proposed hydrologic & water temperature operations models (WR-1) and water quality study (WR-2) described in the Draft Study Program Summary Table, focus only on the Project reservoirs and tunnels at Upper/Lower Bear and Salt Springs Reservoirs. We understand that GreenGen currently maintains that these studies will be sufficient to develop an understanding of the potential for impacts to water rights, operations, and resources downstream of Salt Springs Reservoir. Depending on the structure of the study and the data and methodology used, the proposed analysis may be sufficient to clearly show whether there could be any degree of adverse impacts to water quality, temperature, or volumes from the proposed Project operations or construction. The degree of impacts should be defined in relation to the accuracy and uncertainty of the model analysis, the water quality data collection methods, and the model calibration and validation efforts.

If it is not possible to show with certainty that there will not be a potential for downstream impacts based on the hydrologic and water temperature operations model and a water quality study focused solely on the proposed Project area, a study of the potential impacts to water quality and water temperature resulting from the proposed Project should be expanded to focus on the resource management operations of facilities in the Lower Mokelumne River downstream of Salt Springs Reservoir. The study should analyze the proposed operations of the Project and characterize any potential impacts to water quality within the Project reservoirs as well as the subsequent releases of water into the downstream reservoirs and the Lower Mokelumne River. Potential impacts include but are not limited to the cumulative effects on flow volume, timing, temperature, and water quality resulting from operating the proposed Project.

Goals and Objectives

The primary goal of this study request is to evaluate whether the Project would directly or indirectly impact the ability of potentially affected Agency stakeholders to comply with water temperature requirements at their existing facilities. More specifically, the study should analyze the potential mixing of the deeper cold pools between the Project reservoirs and evaluate the potential changes in water quality resulting from the proposed Project operations. The study should be detailed enough to characterize impacts on water quality parameters within the Mokelumne River Basin, including but not limited to water temperature, dissolved oxygen, and turbidity.

The findings of the study should clearly identify any direct, indirect and cumulative impacts within the Project reservoirs as well as Pardee Reservoir, Camanche Reservoir, and the Lower Mokelumne River. Areas of impacts would be characterized as any areas where a change in downstream flow, timing, or water quality/temperature results from the proposed Project operations. The study should develop appropriate monitoring plans that are detailed enough to identify the extent of the affected area, the anticipated changes to the water quality parameters, the timing of those changes, and analysis of resource impacts resulting from those changes, with the goal of developing control plans to minimize or eliminate any cumulative downstream impacts. To do a thorough impact analysis and to inform the development of the monitoring plan, it will be important to gather sufficient baseline data.

Relevant Resource Management Goals and Public Interest Considerations

The management goals for operation of Pardee and Camanche Reservoir include maintaining a hypolimnetic volume (cold water pool) in Camanche Reservoir for release of cold water to the downstream fishery facilities in the Lower Mokelumne River. The goal of the District is to maintain 28 TAF through the end of October to prevent early turn-over and loss of the cold water volume. A key factor in maintaining the cold water pool from summer through fall is inflow water temperature. As noted in the PAD, upstream operation of the proposed Project may change the temperature, amount, and timing of cold water entering Pardee Reservoir. To ensure that there are no adverse changes to the hypolimnetic volume in Pardee Reservoir, GreenGen must develop a detailed temperature and operations models with a specific focus on cumulative impacts downstream of the proposed Project.

Public Interest

The Project will be constructed and operated upstream of Pardee Reservoir, and it is important to ensure that there are no impacts to the regulatory responsibilities that have been established to promote the stewardship of the Mokelumne fishery as well as flow commitments between EBMUD and other water users within the Mokelumne River Basin.

EBMUD's Mokelumne River flow commitments are determined by hydrology, water rights priorities, agreements with state and federal regulatory agencies, California State Water Resources Control Board (SWRCB) orders and decisions, federal directives, court decrees, and numerous agreements between EBMUD and other Mokelumne River users upstream and downstream of its facilities. To comply with the 1998 Joint Settlement Agreement (JSA) among EBMUD, U.S Fish and Wildlife Service (USFWS), and the California Department of Fish and Wildlife (CDFW), EBMUD meets its flow commitments to the Lower Mokelumne fisheries by providing in-stream flow releases which are dependent on specified water quality and temperature conditions to support populations of anadromous salmonids.

The lower Mokelumne River supports a population of fall-run Chinook salmon which is commercially and recreationally important as well as a population of Central Valley steelhead which is listed as threatened under the Federal Endangered Species Act.

Existing Information and Need for Additional Information

Appendix A of the PAD lists a number of reports and documents related to EBMUD's FERC Project No. P-2916. Information in Appendix A does not include more recent studies focused on water quality and fisheries. EBMUD expects that all existing information relevant to the resources and water quality of the Mokelumne River below Salt Springs will be reviewed. It is also necessary to obtain and include all existing information on PG&E Water Right License 3294, Permit 4100, Application 6737. July 19, 1930.

Proposed Methodology

The modeling methodology, assumptions, and basis for determining pre-project and post-project conditions should be clearly documented in a technical report for review by resource agencies and local stakeholders. The modeling approach should be detailed enough to quantify the proposed Project's ability to maintain the status quo with water obligations and commitments within the Upper and Lower Mokelumne River Basin (Study watershed). The technical report should also detail the metrics, criteria, and rationale used to determine the degree of cumulative impacts that may occur from the proposed Project operations.

It is understood that the proposed Water Quality and Temperature model would be developed using CE-QUAL-W2, a 2-dimensional (2D) water quality and hydrodynamic modeling software package developed by Portland State University. The modeling approach should include the following components to adequately quantify the potential downstream impacts to water quality, temperature, and volume as a result of operating the Project.

1) Scope of Model Analysis

- The modeling effort should encompass a hydrodynamic model of the Project reservoirs and tunnels within the Upper and Lower Mokelumne River Basin. This should include the facility downstream of the Project including Pardee and Camanche Reservoirs associated with FERC License P-2916 and the Lower Mokelumne River.
- The hydrodynamic analysis of each reservoir should be based on hourly temperature and meteorological data to sufficiently assess diurnal effects within the water bodies.

2) Pre- and Post-Project Reservoir Operations

- The Pre-Project (baseline) conditions should reflect all pertinent agreements and limitations between water rights holders within the Mokelumne Basin. Baseline operations of the impacted facilities should adequately reflect rules and operations of the facilities by the corresponding resource agencies.

- For Post-Project conditions, analysis of the proposed Project pumped storage operations should reflect all pertinent agreements and limitations between water rights holders within the Mokelumne Basin as established by the baseline conditions.
- The modeled baseline scenarios should be calibrated and validated to historical streamflow and water quality data. Analysis of post-project conditions should reflect any reservoir operations alternatives that is being considered for the Project.
- Proposed Project operations should evaluate potential impacts by climate change to water availability, temperatures, and meteorological conditions in the Study watershed. Future project conditions should consider the operational impacts of existing facilities within the Study watershed as well as the proposed Project.

3) Model Dataset Collection

- A minimum 20-year period of historic hydrologic records in the Mokelumne River Basin should be evaluated to ensure that the full hydrologic variability of the watershed is captured, including snow accumulation and melt since the Mokelumne is a snow-dominated basin.
- The modeling approach should be robust enough to characterize the impacts to water quality and water temperatures over historic periods of dry and wet years. The results of the modeling analysis should also have sufficient temporal (sub-daily to daily data) and spatial resolution (1-meter) to identify potential areas of impacts and inform the development of water quality monitoring and control plans.
- Meteorological datasets should include Solar Radiation, Minimum & Maximum Air Temperature, Relative Humidity, Cloud Cover, Dew Point, Wind Speed & Direction, Vapor Pressure, and Precipitation.
- Water quality datasets should include Water Temperature, Dissolved Oxygen, Turbidity, pH, Total Dissolved Solid (TDS), and Total Suspended Solids (TSS).

4) Streamflow Data Collection & Monitoring

- To support model calibration of the water quality and temperature analysis, a comprehensive stream flows and water quality data collection plan should be implemented upstream and downstream of the proposed project reservoirs. The study design should also utilize the same monitoring locations and methods developed from the initial data collection effort by PG&E.
- Data collection and monitoring efforts should focus on the North Fork Mokelumne River between Salt Springs and Electra Powerhouse located below Lower Bear Reservoirs. There is currently incomplete streamflow and water quality data within this reach of the Mokelumne River – including outflows from Lower Bear and Salt Springs Reservoir, Tiger Creek Reservoir, and just above the confluence with Middle Fork Mokelumne River.

- Monitoring efforts should also include Tiger Creek Reservoir, where a large volume of water is diverted from the North Fork Mokelumne River at Tiger Creek Reservoir, and is released further downstream at Electra Powerhouse. This portion of water by-passes the existing gages on the North Fork Mokelumne River, but still carries heat downstream.
- To support Pre- and Post-Project water quality monitoring efforts of the study watershed, the following nutrients are the parameters of most concern to EBMUD: Turbity, E. Coli, Fecal Coliform, Total Coliform, Total Organic Carbon (TOC), Dissolved Organic Carbon (DOC), Cryptosporidium & Giardia, Aluminum (Al), Manganese (Mn).

5) Model Calibration & Validation

- The hydrodynamic model analysis and calibration and validation should be assessed for extremes and seasonal variations within the Study watershed. A minimum of two time-periods should be considered: 1) in warmer summer/fall periods and 2) in the cooler winter/spring period.
- Monitoring through observed storm events, over a period of 3 to 5 years, would be important to calibrate and validate modeled reservoir mixing and inflow conditions.

Project Nexus

As noted above, the proposed Project has the potential to negatively impact Mokelumne River fishery resources and EBMUD's ability to meet JSA requirements, especially pertaining to the temperature management of the Mokelumne River. Operations of the proposed Project could also impact the various agreements, SWRCB orders and decisions, federal directives, and court decrees that have been established for water uses within the Upper and Lower Mokelumne River Basin and impact EBMUD's ability to meet the requirements of its FERC license. It is important that the studies for the proposed Project adequately evaluate the potential for impacts.

Level of Effort and Cost

In the PAD, GreenGen has indicated that it has already retained Cardno to initiate water temperature model development to evaluate impacts from the proposed Project operations and has stated that the model will incorporate existing PG&E water temperature data from historic P-137 operations and new data collected specifically to support the Project application. However, it is understood from the PAD and Draft Study Program Summary Table that the spatial extents of the hydrologic and water temperature operations model and water quality modeling will only focus on the Project reservoirs associated with PG&E. This initial modeling effort and study plans should be transparent and detailed enough to clearly quantify any potential adverse impacts to the downstream water quality, temperature, or volume resulting from the proposed Project. If any degree of potential adverse impacts is found, it is critical that GreenGen conduct a study examining impacts further downstream of the PG&E operations to ensure that other FERC licensees on the Mokelumne River are not negatively impacted.