POTENTIAL RESOURCE ISSUE:

- Fish mortality or translocation associated with flow diversion, intake structures or powerhouse facilities.

PROJECT NEXUS:

- Project diversions could result in non-lethal or lethal entrainment of fish species at Project powerhouses and diversion facilities.

POTENTIAL LICENSE CONDITIONS:

- Modification of Project facilities or operations.
- Offset mitigation.

STUDY OBJECTIVES:

- Characterize Project diversions, flowlines, powerhouse turbines, and operations in relation to factors that may affect entrainment or mortality.
- Directly estimate the potential for entrainment and mortality by sampling fish entrainment in the Project flowlines.
- Develop the information necessary to assess the potential fish population/production effects of entrainment.

EXTENT OF STUDY AREA:

- The study area for characterization of the Project diversions and powerhouse turbines includes the three Project flowlines (Kaweah Nos. 1, 2, and3) and powerhouses (Kaweah Powerhouse Nos. 1, 2, and 3).

STUDY APPROACH:

- Characterize Project diversion structures and intakes, flowlines, diversion operations, and powerhouse turbines. Provide either calculated or measured intake velocity fields at each intake structure over the range of potential inflows. Characterize the powerhouse turbine fish survival using literature-based turbine fish survival estimates.
- Directly estimate entrainment and mortality.
    - During five representative time periods, when the Project diversions are operating, quantify fish entrainment into each of the Project flowlines (Kaweah Nos. 1, 2, and 3) using standard fish sampling gear used successfully in numerous entrainment studies (e.g., NID and PG&E 2011; Vogel 2013). Identify the representative sampling periods in consultation with agency biologists/staff. The feasibility of sampling each location will need to be made prior to study implementation, but initially it appears high quality sampling is possible.
        - Sample entrainment for three consecutive days during each sample period.
        - Sample using a modified Kodiak trawl or fyke net in each flowline. Measure the proportion of flow sampled by the net, if the entire flow is not sampled. In the unlikely event high quality net sampling is not feasible, sample the flow field with a combination of video/sonar.

    - Identify, enumerate, and measure the length of entrained fish and record their status (uninjured, injured, and killed).

- Evaluate the potential fish population and production effects of entrainment at the Project diversions using Project operations data, fish population data obtained from the AQ 2 – Fish Population Technical Study Plan (TSP), and literature information.

SCHEDULE:

Date	Activity
November 2017–August 2018	Summarize Project diversion and turbine information, and directly measure entrainment in Project flowlines
September–November 2018	Summarize fish population data and potential effects of entrainment on fish populations/production and prepare draft report
December 2018	Distribute draft report to the stakeholders
December 2018–February 2019	Stakeholders review and provide comments on draft report (90 days)
March–April 2019	Resolve comments and prepare final report
August 2019	Distribute final report in Draft License Application

REFERENCES:

Nevada Irrigation District and Pacific Gas & Electric Company (NID and PG&E). 2011. Technical Memorandum 3-5, Fish Entrainment. Yuba-Bear FERC Project No. 2266-096 and Drum-Spaulding FERC Project No. 2310-173.

Vogel, D. 2013. Evaluation of Fish Entrainment in 12 Unscreened Sacramento River Diversions. Prepared for the CVPIA Anadromous Fish Screen Program and the Ecosystem Restoration Program.