

**POTENTIAL RESOURCE ISSUE:**

Migration and dispersal of fish.

**PROJECT NEXUS:**

Project facilities and operations and potential Project betterments may impede fish passage.

**POTENTIAL LICENSE CONDITION:**

- Instream flow releases.
- Seasonal reservoir elevation constraints.
- Facility modifications.

**STUDY OBJECTIVE(S):**

- Document the location, nature (i.e., natural or Project-related), characteristics (i.e., physical, hydraulic) and importance of fish barriers in bypass reaches, the peaking reach, and the inlets to Project reservoirs and diversion pools.
- Identify Project operations (e.g., instream flow releases and reservoir water surface elevations) that allow for fish passage.

**EXTENT OF STUDY AREA:**

The study area includes the Project bypass reaches, peaking reach, and reservoirs and diversion pools. In addition to the reservoir dams (French Meadows, Hell Hole, Interbay, Ralston), specific fish passage study locations include the following:

- The confluence of the Middle Fork American River with French Meadows Reservoir and the confluence of Five Lakes Creek and the Rubicon River with Hell Hole Reservoir.
- Tributary confluences within the bypass and peaking reaches: Duncan Creek, South Fork Rubicon River, Pilot Creek, Long Canyon Creek, North Fork of Middle Fork American River, Volcano Canyon, Otter Creek, and Canyon Creek.
- Project diversion dams: Duncan Creek, South Fork Long Canyon, North Fork Long Canyon.
- Various potential barriers identified during the 2006 Aquatic Habitat Characterization Study (PCWA 2006).

**STUDY APPROACH:**

- Use the 2005 and 2006 habitat mapping results (PCWA 2006) to determine the location and nature (natural and Project-related) of potential barriers in the bypass and peaking reaches and at tributary confluences (e.g., natural falls, tributary junctions, road crossings, shallow riffles, and diversion or dam structures). Classify each potential barrier based on the falls, chute, and cascade types defined by Powers and Orsborn (1985) or as critical riffles (Thompson 1972; URS 2004). Collect additional data, if necessary, to evaluate fish passage at each barrier (e.g., fall height, riffle cross-section topography).

- At each reservoir and diversion pool, survey for barriers along the low pool to high pool length of each significant tributary (i.e., tributaries that provide rearing or spawning habitat). Identify the location and reservoir elevation of any tributary barriers. Classify the potential barriers based on the falls, chute, or cascade types defined by Powers and Orsborn (1985) or as critical riffles (Thompson 1972; URS 2004). Collect data necessary to evaluate fish passage at the barrier (e.g., fall height, riffle cross-section topography).
- Evaluate fish passage at the potential Project-related fish barriers using the following information:
  - Leaping and swimming capabilities of the fish based on the literature (e.g., Powers and Orsborn 1985; Hoar et al 1978) and fish size and water temperature information from the Fish Population and Water Temperature Technical Studies;
  - Physical and hydraulic characterization of potential barriers based on measurements from the field and/or Project engineering drawings;
  - Seasonality and frequency of flows (over a range of water year types) based on the results of the Hydrology Technical Study; and
  - The fish passage assessment methodology outlined in Powers and Orsborn (1985) and Thompson (1972) modified, where necessary, for the specific species (e.g., rainbow trout, brown trout, hardhead) and barriers within in the study area.
- Determine the potential importance (i.e., population effect) of the Project-related barriers using information on the current distribution and abundance of each fish species, habitat availability and utilization, and associated habitat relative to the barrier (i.e., quantity and quality of habitat upstream and downstream of barrier).
- Coordinate with the Instream Flow Technical Study to provide hydraulics data and modeling to estimate minimum flows necessary to allow fish passage at potential passage barriers evaluated.

### **SCHEDULE:**

To be developed in early 2007.

### **REFERENCES:**

- Hoar, W. S. and D. J. Randall (ed). 1978. Fish Physiology. Academic Press New York.
- Placer County Water Agency (PCWA). 2006. Middle Fork American River Hydroelectric Project (FERC 2079) 2006 Aquatic Habitat Characterization Study Plan. September 8, 2006.
- Powers, P. D. and J. F. Orsborn. 1985. Analysis of Barriers to Upstream Migration: An Investigation of the Physical and Biological Conditions Affecting Fish Passage Success at Culverts and Waterfalls. BPA Report No. DOE/BP-36523-1.
- Thompson, K. 1972. Determining Stream Flows for Fish Life in Pacific Northwest River Basins Commission Instream Flow Requirement Workshop, March 15-16, 1972.