

4.5 Deepwater Intake Entrainment Study Plan

This study is designed to provide information regarding the potential for fish to be entrained at Sacramento Municipal Utility District’s (SMUD) Upper American River Project (UARP) deepwater intakes in the UARP reservoirs. The study is based on the hypothesis that most of the UARP reservoirs have deepwater intakes (more than 50 feet deep when a reservoir is full) and the general fish species composition in the reservoirs are fish which exhibit pelagic behavior during some portion of the year. To evaluate the combination of these facts relative to Project effects, a paper study is proposed. Note that entrainment at UARP shallow water intakes (Gerle Creek Canal, Robbs Peak Reservoir intake, Rubicon Reservoir intake and Buck Island Intake) are addressed in a separate study plan. At an April 25, 2002 meeting, the Aquatics Technical Working Group (TWG) agreed that entrainment at the intakes in Pacific Gas and Electric Company’s Chili Bar Reservoir would be addressed by PG&E in a separate study plan.

4.5.1 Pertinent Issue Questions

The Deepwater Intake Entrainment Study Plan will be used, in part, to address the following Aquatics/Water Issue Question:

4. Do Project diversions have an effect on aquatic biota (e.g., are fish screens or low flow channels in dams necessary)?

4.5.2 Background

As described in Section A, Project Description, of the SMUD’s Initial Information Package (IIP), most of the UARP intakes are located in the deepest part of the reservoirs, and therefore could be considered deepwater intakes (Table 1). A review of the literature indicates that when water temperatures are suitable, trout are found near the surface of large reservoirs due to preferences for temperature, dissolved oxygen, food and cover (May 1973, Warner and Quinn 1995, Baldwin *et al.* 2000, Rowe and Chisnall 1995, McAfee 1966, Raleigh *et al.* 1984. The likelihood of fish entrainment at the UARP deepwater intakes is a function of the actual depth of the intake at different times of the year, the probability that a significant number of fish are in the vicinity of the intake, and the ability of fish to avoid entrainment (approach velocity at the intake as compared to the fishes’ swimming speed).

TABLE 1. Elevations and depths of power, diversion and low level intakes at Sacramento Municipal Utility District’s Upper American River Project Reservoirs. Number in parenthesis is the depth of the intake at normal maximum water surface elevation.				
Reservoir	Normal Max. Water Surface El. (feet)	Intake Invert El. (feet)		Intake Type
		Power/Diversion Intake	Low Level Valve	
Rubicon	6,545	6,533.50 (-11.50)	6,523.00 (-22.00)	Shallow
Buck Island	6,436	6,425.00 (-11.00)	6,420.00 (-16.00)	Shallow
Loon Lake	6,410	6,318.50 (-91.50)	6,325.50 (-84.50)	Deep
Gerle Creek	5,231	5,230.85 (-0.15)	5,186.50 (-44.50)	Shallow
Robbs Peak	5,231	5,201.50 (-29.50)	5,196.00 (-35.00) & 5,206.00 (-25.00)	Shallow
Ice House	5,450	5,363.50 (-86.50)	5,414.00 (-36.00)	Deep
Union Valley	4,870	4,504.68 (-365.32)	None	Deep
Junction	4,450	4,376.00 (-74.00)	4,335.00 (-115.00)	Deep
Camino	2,915	2,842.83 (-72.17)	2,840.00 (-75.00)	Deep
Brush Creek	2,915	2,826.50 (-88.50)	2,775.00 (-140.00)	Deep
Slab Creek	1,850	1,673.91 (-176.09)	1,680.00 (-170.00)	Deep

4.5.3 Study Objectives

The study objective is to determine how likely it is that fish are entrained at each of the UARP’s reservoir deepwater intakes.

4.5.4 Study Area and Sampling Locations

The study area includes Loon Lake, Ice House, Union Valley, Junction, Camino, Brush Creek and Slab Creek reservoirs. The intakes at Gerle Creek Canal and Rubicon, Robbs Peak and Buck Island reservoirs, which are considered shallow water intakes (less than 50 feet deep) and are addressed in a separate study plan. No fieldwork is proposed at the deepwater intakes, so no sampling locations are identified. Also, note that the study area does not include Chili Bar Reservoir. Entrainment at the intakes in Pacific Gas and Electric Company's Chili Bar Reservoir may be addressed by PG&E in a separate study plan.

4.5.5 Information Needed From Other Studies

Information needed from other studies includes 1) the composition of fish species in UARP reservoirs and downstream from the reservoirs from the Fish Survey Study; 2) reservoir elevations, storage and fluctuation from the Hydrology Study; 3) water temperature in the UASRP reservoirs from the Water Temperature Study; and 4) water quality information, especially dissolved oxygen, in the UARP reservoirs from the Water Quality Study Plan.

4.5.6 Study Methods And Schedule

Study methods will include: 1) reviewing the scientific literature (note that Aquatic TWG participants will be contacted to solicit germane information, especially with regards to catostomids in Union Valley Reservoir) to determine how fish species in each of the Project reservoirs likely utilize the reservoir (movement and habitat preference); 2) describe the location of any intakes in the UARP reservoirs including elevation and flow at different times of the year; and 3) when fish are likely to be in the vicinity of the intake, relate the approach velocity into the intake to the fishes' ability to avoid entrainment (swim speed). It is anticipated that a white paper on this subject will be developed for review by the Aquatic TWG and Plenary Group by late 2002. If the Aquatic TWG or Plenary Group conclude that additional information is needed at any intake (such as an entrainment study), the study will be developed by the Aquatic TWG and fieldwork will occur in 2003.

4.5.7 Analysis

Data analysis will include a discussion of the above data, and postulate an effect on fish populations in the reservoir.

4.5.8 Study Output

The white paper will be presented to the Aquatic TWG and Plenary Group by late 2002. Additional studies, if needed, will occur in 2003. The ultimate study output will be a written report that includes the issues addressed, objectives, study area including sampling locations, methods, analysis, results, discussion and conclusions. The report will be prepared in a format so that it can easily be incorporated into the Licensee's draft environmental assessment that will be submitted to FERC with the Licensee's application for a new license.

4.5.9 Preliminary Estimated Study Cost

A preliminary cost estimate for this study will be developed after approval by the Plenary Group.

4.5.10 Plenary Group Endorsement

The Aquatics TWG approved this plan on April 25, 2002. The participants at the meeting who said they could "live with" this study plan were PCWA, El Dorado County, BLM, CDFG, USFS, USFWS, SMUD, SWRCB and PG&E. None of the participants at the meeting said they could not "live with" this study plan. The Plenary Group approved the plan on June 5, 2002. The participants at the meeting who said they could "live with" this study plan were PCWA, El Dorado County, BLM, BOR, USFS, CSPA, SMUD, FOR, PG&E. None of the participants at the meeting said they could not "live with" this study plan.

4.5.11 Literature Cited

- Baldwin, C. M., Beauchamp, D. A., and J. J. Van Tassell. 2000. Bioenergetic assessment of temporal food supply and consumption demand by salmonids in the Strawberry Reservoir food web. *Trans. Am. Fish. Soc.*, 129:429-450.
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