Study 3.8

STREAM FISH POPULATIONS UPSTREAM OF ENGLEBRIGHT RESERVOIR

November 2010

1.0 Project Nexus and Issues

Yuba County Water Agency's (YCWA or Licensee) continued operation and maintenance (O&M) of the existing Yuba River Development Project (Project) has a potential to affect fish in streams upstream of the Englebright Dam.[1]

2.0 Resource Management Goals of Agencies and Indian Tribes with Jurisdiction Over the Resource Studied

[Relicensing Participants - This section is a placeholder in the Pre-Application Document (PAD). Section 5.11(d)(2) of 18 CFR states that an applicant for a new license must in its proposed study *"Address any known resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied."* During 2010 study proposal development meetings, agencies advised License that they would provide a brief written description of their jurisdiction over the resource to be addressed in this study. If provided before Licensee files its Proposed Study Plan and Licensee agrees with the description, Licensee will insert the brief description here stating the description was provided by that agency. If not, prior to issuing the Proposed Study Plan, Licensee will describe to the best of its knowledge and understanding the management goals of agencies that have jurisdiction over the resource addressed in this study. Licensee]

3.0 Existing Information and Need for Additional Information

Some information regarding the stream fish communities in the vicinity of Project facilities is available. Based on a review of existing and available information, fish species listed as threatened or endangered under the federal Endangered Species Act ESA) or California Endangered Species Act (CESA) do not occur in any Project-affected stream reaches upstream of Englebright Dam, and California Department of Fish and Game (CDFG) does not stock fish in any Project-affected stream reaches. Most existing stream fish information is not current or quantitative (e.g., population estimates).

[1] Englebright Dam was constructed by the California Debris Commission in 1941, is owned, operated and maintained by the United States Army Corps of Engineers; and is not included as a Project facility in FERC licenses for the Yuba-River Development Project.

3.1 Middle Yuba River and Yuba River Upstream of Englebright Reservoir

A transition fishery[2] occurs in the vicinity Our House Diversion Dam. As described in Section 7.3.4.1 of the Pre-Application Document, 2004 snorkeling surveys in the Middle Yuba River about 0.5 mile upstream of Our House Diversion Dam found rainbow trout (*Oncorhynchus mykiss)* and Sacramento pikeminnow/hardhead (*Ptychocheilus grandis/Mylopharodon conocephalus)* (the snorkelers were unable to distinguish between the two species); while about 0.5 mile downstream of the dam, the snorkelers found rainbow trout, Sacramento pikeminnow, hardhead, smallmouth bass (*Micropterus dolomieui*), and various sucker species (Family Catastomidae) (Gast et al. 2005). The general species composition upstream of Our House Diversion Dam was confirmed by Nevada Irrigation District (NID) in 2008 and 2009 when its snorkeling surveys in the Middle Yuba River about 0.5 mile upstream of Our House Diversion Dam found Sacramento suckers, rainbow trout, and Sacramento pikeminnow (NID and PG&E 2010). Hardhead is a forest-service sensitive species.

Additional information regarding stream fish in the Yuba and Middle Yuba River between Our House Diversion Dam and Englebright Reservoir is available from Gast et al. (2005) and is summarized in Table 3.0-1.

Table 3.0-1. Distribution of fish species relative to river mile and stream temperature observed during 2004 Middle Yuba River snorkel surveys downstream of Our House Diversion Dam. Note that RM is 12.6 is about 0.5 mile upstream of Our House Diversion Dam.

River Mile (beginning at head of Englebright Reservoir)	Tributary Inflow	Middle Yuba Water Temperature (°C)	Rainbow Trout	Brown Trout	Pikeminnow Hardhead[1]	Pikeminnow	Hardhead	Suckers	Smallmouth Bass	Rainbow (Fry Lane)	Non-game (Fry Lane)
0.0	--	--	--	--	--	--	--	--	--	--	--
0.1	--	23.1°	●	--	--	●	--	--	●	--	--
1.8	Yellowjacket Creek	--	--	--	--	--	--	--	--	--	--
2.6	--	20.4°	●	--	--	●	--	●	●	--	--
4.8	Oregon Creek	21.4°	--	--	--	--	--	--	●	--	--

Source: Gast et al. 2005
[1] Pikeminnow and hardhead less than 4" in length not discernible.

According to Gast et al. (2005), tributaries to the mainstem, having cooler summertime water temperatures and likely provide refuge for salmonids from higher than optimum mainstem water temperatures. Oregon Creek was cooler than the mainstem, appeared to provide good habitat, and was inhabited by rainbow trout. The North Yuba River, at the confluence with the Middle Yuba River also provides ample cool-water trout habitat. At the time of observation, water temperature in the North Yuba River at the confluence with the Middle Yuba River was 18.6°C, which was 4.5°C cooler than the Middle Yuba River water temperature at that time (23.1 °C).

[2] A transition fishery is one that includes both coldwater and warmwater fishes and is typically found in the Sierra in lower elevations where the fish community transitions from a coldwater fishery dominated by trout in the higher elevations to a warm water fishery in the lower elevations.

3.2 Oregon Creek

Licensee was unable to find any existing information regarding the fish community in Oregon Creek near Log Cabin Diversion Dam, but the fish community is likely similar to that at Our House Diversion Dam. Historic samples indicate that there was a hardhead fish population in the diversion pool as recent as 2001 (personal communication, Dan Teater, Forest Service).

3.3 North Yuba River

Recent fisheries information for the North Yuba River upstream of New Bullards Bar was collected in 2008 and 2009 for the Yuba-Bear Hydroelectric Project and Drum-Spaulding Project relicensings (NID and PG&E 2010). Snorkeling surveys approximately 6.5 miles upstream of New Bullards Bar Reservoir found rainbow trout, brown trout (*Salmo trutta*), Sacramento sucker (*Catostomus occidentalis*), and Sacramento pikeminnow/hardhead (the snorkelers were unable to distinguish between the two species). Snorkelers did not find any species listed as threatened or endangered under the federal Endangered Species Act or California Endangered Species Act. In addition, hardhead could not be confirmed to be present or absent due to the snorkeling methodology. Two additional sites further upstream were electrofished and resulted in the capture of only rainbow and brown trout.

Licensee was unable to find any existing information regarding the fish community in the North Yuba River downstream of New Bullards Bar Dam, but the community is likely similar to that at Our House Diversion Dam.

4.0 Study Goals and Objectives

The goal of the study is to provide current information on fish in Project-affected streams.

The objectives of the study are on a site and species specific basis: 1) characterization of fish species composition and relative spatial distribution; 2) estimate of total or relative abundance of fish by species; 3) analysis of fish population size-structure and age-class structure; and 4) calculation of fish condition factor.

5.0 Study Methods and Analysis

5.1 Study Area

For the purpose of this study, the study area includes 1) the Middle Yuba River from and including Our House Diversion Dam Impoundment to the confluence with the North Yuba River, 2) Oregon Creek from and including the Log Cabin Diversion Dam Impoundment to the confluence with the Middle Yuba River, 3) the North Yuba River from and including New Bullard's Bar Dam Reservoir to the confluence with the Middle Yuba River, and 4) the portion of the Yuba River from the confluence of the North and Middle Yuba rivers to the confluence with the normal maximum water surface elevation of the USACE's Englebright Reservoir.

If YCWA proposes an addition to the Project, the study area will be expanded if necessary to include areas potentially affected by the addition.

5.2 General Concepts and Procedures

The following general concepts and practices apply to the study:

- Personal safety is the most important consideration of each fieldwork team.
- Licensee will make a good faith effort to obtain permission to access private property where needed well in advance of entering the property.
- Field crews may make minor variances to the FERC-approved study in the field to accommodate actual field conditions and unforeseen problems. When minor variances are made, Licensee's field crew will follow the protocols in the FERC-approved study.
- When Licensee becomes aware of major variances to the FERC-approved study, Licensee will issue an e-mail to the Relicensing Contact List describing the variance and reason for the variance. Licensee will contact by phone the Forest Service (if the variance is on National Forest System land), USFWS, SWRCB and CDFG to provide an opportunity for input regarding how to address the variance. Licensee will issue an e-mail to the Relicensing Contact List advising them of the resolution of the variance. Licensee will summarize in the final study report all variances and resolutions.
- Licensee's performance of the study does not presume that Licensee is responsible in whole or in part for measures that may arise from the study.
- Global Positioning System (GPS) data will be collected using either a Map Grade Trimble GPS (sub-meter data collection accuracy under ideal conditions), a Recreation Grade Garmin GPS unit (3 meter data collection accuracy under ideal conditions), or similar units. GPS data will be post-processed and exported from the GPS unit into Geographic Information System (GIS) compatible file format in an appropriate coordinate system using desktop software. The resulting GIS file will then be reviewed by both field staff and Licensee's relicensing GIS analyst. Metadata will be developed for deliverable GIS data sets.
- Licensee's field crews will record incidental observations of aquatic and wildlife species observed during the performance of this study. All incidental observations will be reported in the appropriate Licensee report (e.g., incidental observations of special-status fish recorded during fieldwork for the Special-Status Turtles – Western Pond Turtle Study will be reported in Licensee's Stream Fish Populations Study report). The purpose of this effort is not to conduct a focus study (no effort in addition the specific field tasks identified for the specific study) or to make all field crews experts in identifying all species, but only to opportunistically gather data during the performance of the study.
- Field crews will be trained on and provided with materials (e.g. Quat-128 [didecyl dimethyl ammonium chloride], scrub brush, etc.) for decontaminating their boots, waders, and other equipment between study sites. Major concerns are amphibian chytrid fungus (*Batrachochytrium dendrobatidis*), and invasive invertebrates (e.g. zebra mussels, *Dreissena polymorpha*). This is of primary importance when moving: 1) between tributaries and

mainstem reaches; 2) between basins (e.g. Middle Yuba River, Yuba River and North Yuba River); and 3) between isolated wetlands or ponds and river or stream environments.

5.3 Study Methods

The study will be performed in four steps: 1) select sampling sites; 2) collect data; 3) perform a quality assurance/quality control review of the data and analyze the data; and 4) prepare the report. Each of these steps will be repeated for two years, and described below.

Fish sampling is predicated on the Licensee obtaining necessary federal and State of California permits for sampling. Required permits include a CDFG scientific collecting permit for streams that do not contain ESA-listed species. Given the current sampling area, ESA fishes are not expected to be present. Licensee has provided 135 days in the schedule for processing the scientific collecting permit.

5.3.1 Step 1 – Select Sampling Sites

Sampling will occur at the eleven sites described in Table 5.3.1-1.

Table 5.3.1-1. Eleven sampling sites by reach.

Stream	River Reaches	General Location
North Yuba River	New Bullard's Bar Dam Reach	Site located below but in the vicinity of the USGS gaging station downstream of New Bullard's Bar Dam. Site will be determined based on reasonable access and appropriate sampling area (*e.g.*, avoid large substrate and interstitial flowing water common for this section of the river).
		Site located near the confluence of the North Yuba River with the Middle Yuba River.
Oregon Creek	Upstream of Log Cabin Diversion Dam Reach – Non-Project	Site located proximally to Log Cabin Diversion Dam, if possible within 0.5 mile
	Log Cabin Diversion Dam Reach	Site located near the confluence of Oregon Creek with the Middle Yuba River.
Middle Yuba River	Upstream of Our House Diversion Dam Reach – Non-Project	Site located within 0.5 mile upstream of Our House Diversion Dam Reach
	Our House Diversion Dam Reach	Site located within 0.5 mile downstream of Our House Diversion Dam.
		Site located upstream of the Highway 49 Bridge Crossing near RM 4.5.
	Oregon Creek Reach	Site located proximally to Moonshine Creek near RM 3.4.
Yuba River	Middle/North Yuba River Reach	Site located near the confluence of the Middle Yuba River in an accessible location. Access within the reach is limited.
		Site located proximally upstream of the New Colgate Powerhouse (RM 34) where access is available. Site may be quantitatively snorkeled due to the larger stream channel.
	New Colgate Powerhouse Reach	Site located upstream of the influence of the reservoir, but downstream of the influence of the powerhouse. Sites will likely be quantitatively snorkeled due to the larger stream channel. Limited access may be available at Rice Crossing or from access roads of the powerhouse.

Where possible and appropriate, sites will: 1) include habitat representative of the overall reach; 2) be located with any known historic sampling sites; 3) be co-located with sampling sites for Licensee's Instream Flow Upstream of Englebright Dam Study, Special-Status Aquatic Mollusks Study and Benthic Macroinvertebrates Study; 4) be selected using mesohabitat

mapping information availbe when the sites are seleted to help identify sampling sites with mesohabitat types in similar proportion to the larger geomorphic reaches of the river; 5) be chosen far enough upstream or downstream of access locations to minimize the effects of fishing on fish population results, but still be reasonably accessible to field crews; and 6) where comparisons likely are to be made between sampling locations, comparison study sites will be located in sections of river with similar habitat types and similar sampling methods will be used.

Final sampling sites will be selected in consultation with relicensing participants and Licensee will collaborate with interested and available Relicensing Participants regarding sampling locations for each methodology. Licensee will make a good faith effort to schedule the consultation on a day or days convenient to Licensee and interested Relicensing Participants, and will provide an email notice at least 14 days in advance of the meeting or site visit. will be evaluated and selected for each methodology. collaboratively with the relicensing participants. If collaborative agreement is not reached, Licensee will note the disagreements in its final report, including why Licensee did not adopt the recommendation.

5.3.2 Step 2 – Collect Data

5.3.2.1 Preferred Method - Electrofishing

Licensee's preferred sampling method is electrofishing.

At least three passes will be made at each site using backpack electrofishing units. Sample sites vary in length, and will range at a minimum, between 100 and 300 meters (m), unless Relicensing Participants and the Licensee both agree to a shorter length based on available habitat. Upstream and downstream ends will be blocked with fine mesh nets or a fish passage barrier. Licensee's goal in determining site length is to have adequate length to include sufficient usable fluvial habitat represented in that reach (e.g. riffle, pool, glide). Exact site length will be determined in the field by the Licensee.

Block nets will span the full width and depth of the stream except where an upstream fish passage barrier obviates the need for head-end blocking or where only edge or stream margin habitat is to be sampled. If necessary, salt blocks will be placed in the stream immediately above the electrofishing station to increase conductivity. Salt blocks will be used when fish are observed escaping the direct path of the electric field generated by the electrofishing unit at elevated settings.

Field crews will consist of at least two netters for each shocker. Licensee will follow Temple, et al. (2007), who recommends one backpack electroshock crew for streams less than 7.5 m wide and two backpack electrofish crews for streams 7.5 - 15 m wide. In wadeable streams wider than 15 m the number of electroshocking crews will be expanded as necessary to assure effective and accurate sampling.

Captured fish will be retained in aerated buckets and/or live cars until each pass is completed. As described above, fish will be sedated as necessary and with appropriate approvals. All fish

will be identified to species and counted. Effort will be made to measure all fish. Measurements will be to the nearest millimeter (fork length) and weighed by digital scale to the nearest gram. However, measuring will cease if long holding times begin to result in mortality of captured fish. Effort will be made to evenly represent all size classes collected within the subsample of the measured species. The actual number of measured species will be determined through professional judgment based upon the size class homogeneity of the sample (*i.e.*, number of size classes represented). Scale samples will be taken on a subsample of larger, less abundant select fish (hardhead, rainbow trout, and brown trout) for validating length-age indices. Captured fish will be released proximally below the sampling area following completion of each electrofishing pass. Mortalities and fish condition (spinal trauma, burning) will be noted and recorded prior to release. All effort will be made to ensure sampling activities in the field will minimize potential injury or mortality to aquatic species. All data will be recorded on a standardized electrofishing form.

General information and habitat/channel metrics will be collected at each sample site. General information will include site identification, crew members, number of shockers, date and time, air and water temperature, conductivity, weather conditions, and GPS location. Metrics collected at each meso-habitat unit within the sample site will include meso-habitat type, estimated average and maximum depth, estimated average wetted and bankfull width, dominant cover type, dominant and subdominant substrate. Habitat data collected will be consistent with that collected in habitat mapping studies.

Prior to electrofishing at a site that has been previously selected; Licensees will walk the stream-bank to directly observe the presence of any western pond turtles (WPT) or foothill yellow-legged frog (FYLF). If a WPT or FYLF is observed, Licensees will relocate the site upstream or downstream to a location that includes similar habitat types as the selected site, and repeat the procedure (i.e., check for WPT or FYLF and relocate if either is observed). If WPT or FYLF is not observed, Licensees will commence electrofishing. Licensees will adhere to accepted decontamination guidelines to minimize the likelihood of transmitting diseases (USFWS 2005).

5.3.2.2. Alternative or Supplemental Method – Snorkeling

As stated above, Licensee's preferred sampling method is electrofishing. However, as described by O'Neal (2007), snorkeling is often feasible in places where other methods are not; for example, deep, clear water with low conductivity makes quantitative electrofishing prohibitive. Species composition, presence/absence, relative abundance, general size class and habitat use information can be obtained with snorkeling techniques (Slaney and Martin 1987; O'Neal 2007).

Snorkeling will only be used by Licensee to replace electrofishing if the entire sampling site is too deep to electrofish.
Snorkeling may be used by Licensee to supplement electrofishing in habitat types that do not lend themselves to electrofishing, if portions of a site do not lend themselves to electrofishing based upon depth, current velocity, and other physical considerations (e.g., access or safety).

If used, snorkeling techniques will generally follow those outlined by Thurow (1994), Dolloff et al. (1996), and O'Neal (2007). Surveys will be conducted during the day and during periods with the low annual turbidity levels (generally late summer).

If snorkeling surveys are to be performed within a section of stream where electrofishing has occurred, snorkeling surveys will be conducted immediately after electrofishing is complete. Snorkel lanes will run the full length of each sample unit within the survey site. One diver will swim a lane. Generally two to three divers (as determined by the wetted stream channel width at each site) will snorkel the lanes and record species composition and abundance. Fish will be identified, counted, and visually categorized into pre-defined length-classes (0-2 in., >2-4 in., >4-6 in., >6-8 in., >8-10 in., >10-12 in., >12-14 in., etc.). Observers will calibrate estimated fish lengths by viewing painted wooden dowels of varying known lengths underwater. Visual estimates of length will be made in English units and later converted to metric units to avoid error. Maximum sight distance for accurate determination of fish species will be recorded on the field data form. Two to three replicate snorkel surveys will be performed using the same diving team to assess efficiency, obtain an estimate of survey variance, and determine a level of confidence for use in abundance estimation (Slaney and Martin 1987; Hankin and Reeves 1988). Data will be recorded on a standardized fish snorkeling survey form and attached to the electrofishing form for the site. The site information and habitat metrics collected for the electrofishing prior to snorkeling will be used for the snorkel datasheet. Snorkeling data will be analyzed separately from the electrofishing data.

5.3.3 Step 3 – QA/QC Analysis and Information Analysis

Following a quality control/quality assurance review, data will be entered into and organized in an Excel spreadsheet. Some parameters may be analyzed in Excel while other parameters will be analyzed using published public domain scientific software for calculating stream fish population statistics. While all species will be recorded, small sample sizes of some species may limit some statistical analyses.

5.3.3.1 Individual Fish Condition Factor

Fish size and weight data will be summarized by species and by sample site. Standard scientific software outputs including minimum, maximum, and mean fork length and weight will be calculated. Length and weight data will be used to calculate a relative condition factor (K_n) (Anderson and Gutreuter 1983) and to provide a general indication of the health of individuals, where factors greater than 1 indicate more healthy individuals. Fulton and relative condition factors for electrofishing sites will be stream and species specific, for length and weight data collected at all quantitative electrofishing sites.

5.3.3.2 Fish Species Populations and Biomass

Standing stock estimates in terms of fish population numbers and biomass will be calculated by species for each site and analyzed by age class. Electrofishing data will be analyzed using a scientific software package (*e.g.* Microfish or other similar program). Capture probabilities (the

proportion of fish captured on a given electrofishing pass), size statistics, and biomass will be generated for each sample site using fish capture data. Biomass will be calculated based upon total weight measured for each species. Standing stock estimates will be reported as: 1) numbers and weight (g) of fish by species per 100 m of stream; 2) numbers of fish by species per mile; 3) pounds of fish by species per acre of stream surface; and 4) kilograms of fish by species per hectare.

Fish species population analysis will include size structure based on relative stock densities. To provide an index of size structure for each site, traditional relative stock densities (RSD) of each species will be calculated. The RSD will be presented on a scale of 0 to 100 (Anderson and Neumann 1996). RSD will be calculated as the proportion of fish sampled greater than 6 inches, i.e.: RSD = (# of fish >6-inch in sample) / (# of fish in sample) x 100. The 6-inch length was chosen because it is often used as the smallest size where fish are desired by anglers. A high RSD indicates that a greater proportion of the population consists of fish in the size class desirable to anglers.

Fish species population will also include an analysis by age class. Existing length-age indices will be used to determine the age class. Length-age indices are relatively accurate for smaller fish; however, confidence intervals reduce with larger fish. Scales collected as described above will be read to assist in identifying age class breaks. Regression analysis will be used to analyze the data and if necessary, adjust the indices.

5.3.3.3 Fish Community Analysis

Analysis will also include species composition and relative abundance of the fish community (i.e. percent composition). The diversity of fish species will be assessed in Project reaches as the data allows. Possible statistical analysis could include the Shannon Weaver Diversity Index, a means of characterizing the evenness of species diversity.

The condition of fish communities will also be evaluated based on the rigor of the collected data described above at three levels of biological organization: individual level, population level, and community level. Moyle et al. (1998) and Moyle and Marchetti (1998) provided the following descriptions of fish health at these levels:

5.3.3.3.1 Individual Level

Most fish in a healthy stream should: 1) have a robust body; 2) be free of disease, parasites, and lesions; 3) possess reasonable growth rates for the region; and 4) exhibit appropriate behavioral patterns.

5.3.3.3.2 Population Level

Fish populations in healthy stream environments: 1) exhibit multiple age classes indicating that reproduction is regularly occurring; 2) achieve a viable population size (i.e., occur in adequate

numbers to maintain a self-sustaining population and the long-term persistence of the population); and 3) consist of mostly healthy individuals.

5.3.3.3.3 Community Level

Fish communities considered in good health in California: 1) are typically dominated by co-evolved species; 2) have a predictable structure as indicated by limited niche overlap among species and trophic levels; 3) are resilient in recovering from extreme events; 4) consist of a persistent species membership; and 5) are replicated geographically (i.e., can be found in similar habitats within the drainage or in other similar drainages).

5.3.4 Prepare Report

Licensee will prepare a report that includes the following sections: 1) Study Goals and Objectives; 2) Methods; 3) Results; 4) Discussion; and 5) Description of Variances from the FERC-approved study proposal, if any. The report will also contain GIS maps of sampled areas, organized and labeled photos of each site, and relevant summary tables and graphs. The reported data will be organized by basin, reach, and site to allow for a spatial presentation of the findings. At the end of each sampling year, raw QA/QC'd data will be made available to Relicensing Participants.

6.0 Study-Specific Consultation

This study proposal includes the following study-specific consultation:

- Invite interested and available Relicensing Participants into the field to comment on selection of sampling sites.

7.0 Schedule

Licensee anticipates the schedule to complete the study as follows assuming the PAD is filed on November 1, 2010, and FERC issues its Study Determination by October 4, 2011:

Project Preparation and Site Selection ..... October - November 2011
Field Sampling ..... June - August 2012,2013
Data QA/QC ..... September 2012,2013
Prepare Report ..... September - October 2013

8.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methodologies described above for stream fish population data collection are typical of recent relicensings in California.

9.0 Level of Effort and Cost

[Relicensing Participants – YCWA will include a cost range estimate for this study in its Proposed Study Plan. Licensee]

10.0 References Cited

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