

Study 3.2

AQUATIC MACROINVERTEBRATES DOWNSTREAM OF ENGELBRIGHT RESERVOIR¹

October 2011

1.0 Project Nexus

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 aquatic macroinvertebrates (BMI).

2.0 Resource Management Goals of Agencies with Jurisdiction Over the Resource to be Studied

YCWA believes that four agencies have jurisdiction over aquatic macroinvertebrates and the resources that could be potentially affected in the geographic area included in this study proposal: 1) the United States Department of Interior, Fish and Wildlife Service (USFWS); 2) United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); 3) California Department of Fish and Game (CDFG); and 4) State Water Resources Control Board, Division of Water Rights (SWRCB). Each of these agencies and their jurisdiction and management direction, as understood by YCWA at this time, is discussed below.

USFWS

USFWS's jurisdiction and goals and objectives are described by USFWS on pages 1 through 3 of USFWS's March 7, 2011 letter to FERC that provided USFWS's comments on YCWA's Pre-Application Document, or PAD (YCWA 2010). USFWS's jurisdiction, goals and objectives are not repeated here.

NMFS

NMFS's statutory authorities and responsibilities are described by NMFS in Section 2.0 of Enclosure A in NMFS's March 7, 2011 letter to FERC providing NMFS's comments on YCWA's PAD. NMFS's jurisdiction and responsibilities are not repeated here.

CDFG

CDFG's jurisdiction is described by CDFG on page 1 of CDFG's March 2, 2011 letter to FERC providing CDFG's comments on YCWA's PAD. CDFG's goal, as described on page 2 of CDFG's letter is to preserve, protect, and as needed, to restore habitat necessary to support native fish, wildlife and plant species.

¹ YCWA included a study titled, "Aquatic Macroinvertebrates Downstream of Englebright Reservoir" in its August 2011 Revised Study Plan. FERC's September 30, 2011 Study Determination required modifications to the study. Those modifications have been made in this study plan.

SWRCB

SWRCB has authority under the federal Clean Water Act (33 U.S.C. §11251-1357) to restore and maintain the chemical, physical and biological integrity of the Nation's waters. Throughout the relicensing process the SWRCB maintains independent regulatory authority to condition the operation of the Project to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, CEQA, and any other applicable state law.

3.0 Existing Information and Need for Additional Information

Sampling for BMI occurred in stream reaches potentially affected by the Project as recently as 2007. The South Yuba River Citizens League (SYRCL) collected samples at Parks Bar on the lower Yuba River (2006-2007) using the California Stream Bioassessment Protocol. Samples were always taken in September. Low diversity was observed at Parks Bar, located below Englebright Dam. Low diversity may have been the result of bias associated with using a protocol for wadeable streams in a large unwadeable river.

Additional data is needed to address the identified issue.

4.0 Study Goals and Objectives

The goal of the study is to characterize BMI assemblages within Project-affected reaches below Englebright Dam. The objective of the study is to collect aquatic macroinvertebrate and physical data to meet the study goals.

5.0 Study Methods and Analysis

5.1 Study Area

Sampling above Englebright Dam is addressed in a separate study plan, therefore the current plan only addresses habitat below the Dam to the confluence with the Feather River.

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. GIS maps will be provided to agencies in a form, such as ESRI Shapefiles, GeoDatabases, or Coverage with appropriate metadata, that is useful for interactive data analysis and interpretation. Metadata will be Federal Geographic Data Committee (FGDC) compliant.²
- 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 (i.e., 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) for decontaminating their boots, waders, and other equipment between study sites. Major concerns are amphibian chytrid fungus, and invasive invertebrates (e.g., zebra mussel, *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.

² The Forest Service and CDFG each have requested that a copy of the GIS maps be provided to them when the maps are available.

5.3 Study Methods

The study methods consist of the following four steps: 1) select sampling sites; 2) collect macroinvertebrate and habitat data; 3) data analysis; 4) QA/QC data; and 5) prepare report. Each of these is discussed below.

YCWA will obtain all necessary permits prior to performing fieldwork.

5.3.1 Step 1 – Select Sampling Sites

YCWA will collect BMI data at six sites, which are proportionally spaced between Englebright Dam and the Feather River. The general locations, from upstream to downstream on each reach, are:

- Downstream of Narrows 2 Powerhouse and above Deer Creek
- Near UC Field Station (Timbuctoo Bend)
- Parks Bar to Long Bar Area
- Main channel at Hammon Bar (Upstream of USACE’s Daguerre Point Dam)
- Downstream of USACE’s Daguerre Point Dam
- Near Hallwood Boulevard

YCWA will select the specific sample site locations, within the specified stream reaches, after consultation with the SWRCB, USFWS, NMFS, CDFG, and Forest Service.³

5.3.2 Step 2 – Collect Data

Generally, the Surface Water Ambient Monitoring Program (SWAMP) is used as the standard methodology for aquatic macroinvertebrate assessments in California. However, this method is designed for wadeable streams and is not adapted for unwadeable riverine habitat being sampled in this effort. The United States Environmental Protection Agency (USEPA) has developed a method to accommodate unwadeable habitat called the Environmental Monitoring and Assessment Program (EMAP) – Surface Waters (Lazorchak et al. 2000). A hybrid to this method is the Large River Bioassessment Protocol (LR-BP). Like the EMAP – Surface Waters, the LR-BP uses transect and main channel sampling and can be applied in a systematic, unbiased manner for bioassessment. The LR-BP is a combination of semi-quantitative multi-habitat sampling methods applied in a systematic randomized fashion that has been studied for its performance characteristics and variability and was designed to be standardized, quantitative,

³ YCWA’s Aquatic Macroinvertebrates Downstream of Englebright Reservoir Study in its August 2011 Revised Study Plan stated “YCWA will select the sites, and then invite interested and available Relicensing Participants into the field to comment on selected sites.” However, FERC’s September 30, 2011 Study Determination stated: “we recommend the last paragraph of section 5.3.1 be replaced with the following text: YCWA will select the specific sample site locations, within the specified stream reaches, after consultation with the Water Board, FWS, NMFS, Cal Fish and Game, and Forest Service.” The study plan has been modified accordingly.

and user friendly (Flotemersch et al. 2006). It incorporates proportional multi-habitat sampling and, therefore, should accurately reflect site condition. This method was shown to be responsive to a gradient of disturbance and can be used on a variety of large rivers (Flotemersch et al. 2006). Methods utilized in the collection of aquatic macroinvertebrates and sampling of habitat parameters in this study were derived from the two protocols.

5.3.2.1 Reach Setup

Reach length will be 500 meters (m) as used in the LR-BP. This length has been shown to provide representative samples and is manageable for investigators due to the entire reach usually being observable from a single point (Flotemersch et al. 2006). The beginning sample point will be located at the upstream end of the reach and will be randomly selected within a designated site and marked by GPS coordinates. At each site, there will be a total of six transects. Transect A will be located at the upstream end of the reach with the remaining five transects (B – F) at 100 m, 200 m, 300 m, 400 m, and 500 m. At each transect, a 20-m sample zone (i.e., 10 m on each side of transect) on the chosen bank defines where macroinvertebrates will be collected. The bank to be sampled will be determined by coin toss at the start of the day and all remaining transects will be sampled from that bank unless safety concerns or physical attributes (i.e., steep cut-bank or obstructions) prohibit sampling. In the instance that a designated bank cannot be sampled, the alternate bank will be sampled. If a selected bank for a reach is deemed not to be representative of both banks (i.e., shallow, sunny, unchanging aspect) then sampling of left and right banks will be alternated between transects. The zone to be sampled extends 10 m into the channel from the waters edge but will not exceed a depth of 1 m.

5.3.2.2 Macroinvertebrate Collection

Twelve sweeps, each 0.5 m in length, will be collected within the sample zone using a D-frame net (500- μ m mesh). Each sweep will cover 0.15 m² of substrate (i.e., net width of 0.3 m and a 0.5 m length of pass); therefore, 12 sweeps will cover an area of 1.8 m². The 12 sweeps will be proportionately allocated based on available habitat within the 20 m sample zone (e.g., snags, macrophytes and cobble). This method negates the need for separate collection nets in the field and helps standardize the area sampled. If water at a site is more than 1 m deep at the water's edge, the 12 sweeps will be collected from a boat, if possible. Samples from each transect will be composited into a single sample for the entire reach. Samples will be preserved with 95 percent ethanol, and labeled to form a single composite sample for that study site. This results in each sample containing debris and organisms from 6 separate zones (total of ~12 m²) that represent the 500-m reach.

5.3.2.3 Physical Habitat Characterization and Water Quality

On the day of sampling, water quality measurements will be collected once with a handheld water quality meter (i.e., Hydrolab or YSI) and will include temperature, conductivity, and dissolved oxygen.

Physical habitat will be characterized over the length of the reach and at each transect. Habitat parameters to be collected are outlined in the following list:

- Reach-wide parameters to be collected every 10 m between transects following the thalweg of the stream:
 - Thalweg depth.
 - Classify habitat type (pool, glide, riffle, rapid, cascade, falls, or dry), record presence of backwater and off-channel habitats.
 - Determine dominant substrate visually or using a sounding rod.

- Transect parameters collected at each of the six transects:
 - GPS coordinates of the transect.
 - Photos from each transect looking upstream and downstream
 - Gradient (clinometer) from one transect to the next.
 - Bearing (compass) from one transect to the next.
 - Wetted width (laser range finder).
 - Mid channel bar width, if present.
 - Bankfull width and height (estimate).
 - Incision height (estimate).
 - Bank Angle (estimate).
 - Riparian canopy cover (densitometer) in four directions from the waters edge 1 ft above the water surface.
 - Shoreline substrate in the first 1 m above the waterline (estimate dominant and subdominant size class).
 - Estimate diameter, height, species, and distance from water's edge of largest visible riparian tree.

- Transect parameters to be collected within plot that extends 10 m streamward from the water's edge and 10 m upstream and downstream of each transect:
 - At five systematically spaced locations within the plot measure depth and classify dominant and subdominant substrate size class.
 - Tally large woody material (LWM) in plot and in bankfull channel by size and length class.
 - Aerial cover class of fish concealment features, including: filamentous algae, aquatic macrophytes, LWD, overhanging vegetation, undercut banks, boulders, artificial structures.

- Transect parameters to be collected within plot that extends 10 m landward from the bankfull margin and 10 m upstream and downstream of each transect:
 - Estimate aerial cover class and type of riparian vegetation in canopy, mid-layer, and ground cover.

- Observe and record human activities and disturbances and their proximity to the channel.

5.3.2.4 Macroinvertebrate Sorting

Each composite sample will be rinsed in a standard no. 35 sieve (0.5 mm) and transferred to a tray with twenty, 4-inch-square grids for subsampling, which will be performed using a stereomicroscope with magnifications of 10 to 20 times magnification.

Subsamples will be transferred from randomly selected grids to Petri dishes where the aquatic macroinvertebrates will be removed indiscriminately with the aid of a stereomicroscope and placed in vials containing 70 percent ethanol and 2 percent glycerol. In cases where aquatic macroinvertebrates abundance exceeds 100 organisms per grid, half grids will be delineated to assure that a minimum of three discreet areas within the tray of benthic material will be subsampled. At least 500 aquatic macroinvertebrates will be subsampled from a minimum of five grids, or five half grids.

The debris from the processed grids will be placed in a remnant jar and preserved in 70 percent ethanol for later quality control testing. Subsampled aquatic macroinvertebrates will be identified by a taxonomist approved by the California Department of Fish and Game (CDFG) for USEPA evaluations using standard aquatic macroinvertebrate identification keys (*e.g.*, Kathman and Brinkhurst 1998, Merritt and Cummins 1996, Stewart and Stark 1993, Thorp and Covich 2001, Wiggins 1996) and other appropriate references.

All organisms retained on a 0.5-mm screen will be removed from the subsample and a standard level one taxonomic effort will be used as specified in the Southwestern Association of Freshwater Invertebrate Taxonomists (SAFIT) (SAFIT 2006). Historical datasets that may have been identified using a different method, such as CAMLnet (CDFG 2003) or to a different taxonomic level will be standardized to the SAFIT level 1 before calculating metrics or running statistical analyses.

Finally, the CDFG Aquatic Bioassessment Laboratory (ABL) will be contracted to perform an external QC review of the sample identification. Twenty percent of the samples collected will be randomly selected for QC by the taxonomist and sent to the CDFG ABL.

5.3.3 Step 3 - Data Analysis

Standard biological metrics, plus additional relevant metrics, will be calculated for each site (Table 5.3.3-1) and presented in graphical or tabular form.

Table 5.3.3-1. Biological metrics calculated to assess BMI assemblages

BMI Metrics	Description	Predicted Response to Impairment
RICHNESS MEASURES		
Taxonomic Richness	Total number of individual taxa	Decrease
No. EPT Taxa	Number of taxa in the insect orders Ephemeroptera, Plecoptera, and Trichoptera	Decrease
Ephemeroptera Taxa	Number of mayfly taxa	Decrease
Plecoptera Taxa	Number of stonefly taxa	Decrease

Table 5.3.3-1. (continued)

BMI Metrics	Description	Predicted Response to Impairment
RICHNESS MEASURES (continued)		
Trichoptera Taxa	Number of caddisfly taxa	Decrease
Coleoptera Taxa	Number of beetle taxa	Decrease
COMPOSITION MEASURES		
% EPT	Percent of the composite of mayfly, stonefly, and caddisfly larvae	Decrease
% Ephemeroptera	Percent of mayfly nymphs	Decrease
Shannon Diversity Index	General measure of sample diversity that incorporates richness and evenness	Decrease
TOLERANCE/INTOLERANCE MEASURES		
California Tolerance Value (CTV)	CTVs between 0 and 10 weighted for abundance of individuals designated as pollution tolerant (higher values) and intolerant (lower values)	Increase
No. of Intolerant taxa	Taxa richness of those organisms considered to be sensitive to perturbation	Decrease
% Tolerant Organisms	Percent of macrobenthos considered to be tolerant of various types of perturbation	Increase
% Dominant Taxon	Measures the dominance of the single most abundant taxon. Can be calculated as dominant 2, 3, 4, or 5 taxa	Increase
FEEDING MEASURES		
% CF+CG Individuals	Percentage of BMIs within the collector-filterer and collector gatherer functional feeding groups	Increase
% Scrapers	Percent of macroinvertebrates that graze upon periphyton	Variable
% Non-gastropoda Scrapers	Percentage of BMIs within the scraper functional feeding group excluding gastropod scrapers	Decrease
% Predators	Percent of macroinvertebrates that prey on living organisms	Decrease
% Shredders	Percent of macroinvertebrates that shred leaf litter	Decrease

5.3.5 Step 4 – Prepare Format and Quality Assurance/Quality Control Data

Following data collection and identification of taxa, YCWA will subject all data to quality assurance/quality control (QA/QC) procedures including, but not limited to, spot-checks of data and review of electronic data for completeness. If any datum seems inconsistent, YCWA will investigate the problem. Data QA/QC will include the CDFG ABL review described above.

5.3.6 Step 5 – Prepare Report

YCWA will prepare a report that includes the following sections: 1) Study Goals and Objectives; 2) Methods and Analysis; 3) Discussion; and 4) Description of Variances from the FERC-approved study proposal, if any. In addition, the report will compare the data collected with any historic data that are available.

6.0 Study-Specific Consultation

The study includes the following study-specific consultation:

- YCWA will select the specific sample site locations, within the specified stream reaches, after consultation with the SWRCB, USFWS, NMFS, CDFG, and Forest Service (Step 1).

7.0 Schedule

YCWA anticipates the schedule to complete the study as follows, assuming FERC issues its Study Determination by September 16, 2011 and the study is not disputed by a mandatory conditioning agency:

Select Sampling Sites (Step 1).....	May 2012
Collect Data (Step 2).....	August-September 2012
Analyze Data (Step 3).....	August 2012
QA/QC (Step 4)	August 2012
Prepare Report (Step 5).....	September 2012

8.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is consistent with the methods used for the assessment of BMI in unwadeable riverine habitat being sampled in this effort.

9.0 Level of Effort and Cost

YCWA estimates the cost to complete this study in 2011 dollars is between \$125,000 and \$175,000.⁴

10.0 References Cited

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⁴ YCWA's Aquatic Macroinvertebrates Downstream of Englebright Dam Study in its August 2011 Revised Study Plan had an estimate cost range of between \$125,000 and \$175,000. The modifications required by FERC did not affect the estimated cost range.

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