February 12, 2011

***Filed via Electronic Submittal (E-File)***

Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

**SUBJECT:** Yuba River Development Project
FERC Project No. 2246-058
Redlined Study Proposals

Dear Secretary Bose:

On November 5, 2010, Yuba County Water Agency (YCWA or Licensee) filed with the Federal Energy Regulatory Commission (FERC) a Pre-Application Document (PAD) in support of YCWA's intent to file an application for a new license for the Yuba River Development Project, FERC Project Number 2246 (Project). YCWA is the existing licensee, and current owner and operator of the Project. The initial license for the Project was issued by the Federal Power Commission (FERC's predecessor) to YCWA on May 16, 1963, effective on May 1, 1963. The Federal Power Commission's May 6, 1966 Order Amending License changed the license's effective date to May 1, 1966, for a term ending on April 30, 2016.

To facilitate early and efficient discussion among federal, state and local agencies, Native American tribes, non-governmental organizations, businesses and members of the public (collectively referred to as Relicensing Participants) and YCWA regarding data gathering/study proposal development, YCWA included 41 detailed study proposals in its PAD.

Between November 5, 2010 and the date of this letter, YCWA and various Relicensing Participants held eight meetings and/or conference calls to discuss some of the study proposals included in the PAD. As a result of these meetings, YCWA agreed to modify the following 10 study proposals that were in the PAD:

- Study 1.1: Channel Morphology Upstream of Englebright Reservoir
- Study 2.3: Water Quality
- Study 2.4: Bioaccumulation
- Study 2.5: Water Temperature Monitoring
- Study 3.3: Special-Status Amphibians - Foothill Yellow-Legged Frog Surveys
- Study 3.8: Stream Fish Populations Upstream of Englebright Reservoir
- Study 5.1: Special-Status Plants

- Study 6.1: Riparian Habitat Upstream of Englebright Reservoir
- Study 12.1: Historic Properties
- Study 13.1: Native American Traditional Cultural Properties

In an attempt to ease the comment process on the PAD for Relicensing Participants, YCWA attaches to this letter the above study proposals showing the agreed upon modifications in redline.[1]

At this time, it is YCWA's intent to include each of the above study proposals as modified in YCWA's Proposed Study Plan that will be filed by YCWA with FERC by April 19, 2011. However, YCWA reserves its right to further modify each of the attached study proposals, including the redlined sections, based on comments on the PAD to be filed with FERC by March 7, 2011, and based on additional discussions with Relicensing Participants.

By this filing, YCWA does not imply that Relicensing Participants might not have additional comments on each of these study proposals, including the redlined sections, or on other study proposals in the PAD, or might not request studies not included in YCWA's PAD.

If you have any questions regarding this matter, please contact me.

Sincerely,

YUBA COUNTY WATER AGENCY

for Geoffrey L Rabone

Curt Aikens
General Manager

Attachments: Ten Redline Study Proposals

cc: Alan Mitchnick – FERC DC
Relicensing Participants (via E-mail)

[1] The redlined study proposals are also available on YCWA's Yuba River Development Project Relicensing Website (www.ycwa-relicensing.com). Under "YCWA PAD Studies" on the Quick Launch bar, open the file with the study name and the file name suffix "– Redline 021111." As requested by Relicensing Participants, YCWA has deleted from the folder on the Website the version of each redline study proposal attached to this letter that was in the PAD (i.e., only the redline version is on YCWA's Relicensing Website). The folder contains the 31 study proposals that have not been redlined (i.e., no suffix in the file name).

Study 1.1

# CHANNEL MORPHOLOGY UPSTREAM OF ENGLEBRIGHT RESERVOIR

February 11, 2011

## 1.0 Project Nexus

Yuba County Water Agency's (Licensee or YCWA) continued operation and maintenance (O&M) of the existing Yuba River Development Project (Project) has a potential to affect channel morphology and fluvial processes, which could affect channel morphology upstream of the United States Army Corps of Engineer's (USACE) 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 Study Goals and Objectives

The goal of the study is to quantify or characterize river form and process and interaction with the riparian zone in reaches upstream of the normal maximum water surface elevation of Englebright Reservoir potentially affected by the Project.

The objectives of the study are to develop information necessary to meet the study goal. Specifically, the study objectives include: 1) develop a quantitative and qualitative understanding of Project effects on substrate mobility, particle size distribution, ~~trout spawning gravel distribution,~~ spill channel flow effect on channel morphology, and erosion, and floodplain connectivity at multiple scales.

[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.

# 4.0 Existing Information and Need for Additional Information

Considerable information exists. Much of this information has been obtained or developed by Licensee and is provided in YCWA's Yuba River Development Project relicensing Preliminary Information Package (YCWA 2009). The information includes but is not limited to:

- Topographic and hydrographic information of the Project-affected reaches (Preliminary Information Package, Section 3.0 General Description of River Basin and Appendix D - Project Maps)
- Hydrologic information, modeling and statistics for Project-affected reaches (Preliminary Information Package, Section 7.2 Water Resources and Appendix F - Hydrology)
- Operations procedures for Project facilities (Preliminary Information Package, Section 6.0 Project Location Facilities and Operations)
- Low altitude aerial video of all Project-affected reaches and facilities (Preliminary Information Package, Appendix E - Project Helicopter Video)
- Existing information regarding sediment yields (Preliminary Information Package, Section 7.1.5.1 Geology and Soils)
- Preliminary classification of Project reach types conducted by Licensee in 2009 (Preliminary Information Package, Section 7.1.7.2 Geology and Soils)
- Sediment management and volumes removed from Our House Diversion Dam (Preliminary Information Package, Section 7.7.1.2. Geology and Soils)

Information not included with the Preliminary Information Package, but that is available as Attachment 3.10A to Licensee's Instream Flow Study Proposal (Study 3.10) is a Habitat Mapping Report of the Yuba River Development Project done by Licensee in 2009. This report includes channel and habitat descriptions of ground-mapped and video mapped Project-affected streams; substrate, bank material, large woody debris (LWD) counts, estimated of quantity of salmonid spawning sized gravel, potential natural barriers to upstream fish movement, notes regarding access, and photographs.

To achieve the study goals, additional information is needed, which includes:

- Review of current and historic aerial photographs
- Field measurement of cross-section profiles
- Stage-discharge relationship, based on field measurement of calibration flows, to use in sediment transport model for sediment mobility and, in conjunction with flow frequency analysis, frequency of floodplain inundation
- Field measurement of longitudinal profile

 

- ~~Field measurement of particle size and distribution, including specific measurement of patches of 0.25 to 2.54.05 inch (in.) diameter gravel. (spawning size gravel for trout).~~Mapping and classification of textural facies.
- Distribution and size of channel morphological features such as bedrock outcrops, boulders, gravel accumulations, and floodplains.
- Assessment of condition of riparian zone and distribution of riparian vegetation (e.g., bars, alluvial fans).
- Spill channel flow and erosion.
- Extent and description of influence of New Bullards Bar Reservoir elevation on Slate Creek.
- Extent and description of influence of Our House Diversion Dam on Middle Yuba upstream of Our House Diversion Dam.
- Extent and description of influence of Log Cabin Diversion Dam on Oregon Creek upstream of Log Cabin Diversion Dam.

# 5.0 Study Methods and Analysis

The study includes collecting data to develop a quantitative and qualitative understanding of the effects of regulation on the interactions of hydrology, channel morphology, and the riparian environment in stream reaches upstream of the Englebright Reservoir potentially affected by the Project.

## 5.1 Study Area

The study area includes: 1) the Middle Yuba River from Our House Diversion Dam to the confluence with the North Yuba River; 2) Oregon Creek from the Log Cabin Diversion Dam to the confluence with the Middle Yuba River; 3) the North Yuba River from New Bullards Bar Dam to the confluence with the Middle Yuba River; 4) the portion of the Yuba River from the confluence of the North and Middle Yuba rivers downstream to the normal maximum water surface elevation of Englebright Reservoir; and 5) the portion of the Middle Yuba, Oregon Creek, and Slate Creek affected by base-level control exerted by either the diversion dam (Our House, Log Cabin) or reservoir water level (New Bullards Bar).

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 (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.

## 5.3 Study Methods

The study will be performed in six steps: 1) select study sites; 2) field measurements; 3) assess sediment mobility; 4) QA/QC data; 5) analyze data; and 6) prepare report. Each step is described below.

### 5.3.1 Step 1 - Select Study Sites

Licensees will co-locate study sites to the extent possible with the Licensee's Study 3.9 Instream Flow Above Englebright Reservoir and Study 6.1 Riparian Habitat Above Englebright Reservoir. Instream Flow study sites (transect or transect cluster locations as part of the PHABSIM ["Physical Habitat Simulation"] aspect of the Instream Flow study) are selected within a reach to represent the range of channel and habitat types in the reach (Bovee 1982). The characteristic feature of a PHABSIM study reach is homogeneity of the channel structure and flow regime. The sites chosen will represent those sites most likely to exhibit effects of Project features and operations on channel morphology and habitat features.

Based on historic and habitat mapping information, in the Middle and North Yuba rivers and in the Yuba River upstream of Englebright Reservoir, channel characteristics are primarily controlled by bedrock and boulders, rather than fluvial processes. In other words, these channels are not usually "self-formed" and boulders and bedrock control lateral and vertical stability. Bedrock channels are generally insensitive to short-term changes in sediment supply or discharge. Only a persistent decrease in discharge and/or an increase in sediment supply sufficient to convert the channel to an alluvial morphology would significantly alter bedrock channels (Montgomery and Buffington 1993). However, there may be localized changes to morphology and substrate distribution that may affect aquatic ecology.

Characteristics of the areas where channel morphology sites will be placed are gradients less than 2 percent, accumulations of gravel and finer material in channel and on margins, and floodplain and/or terrace development. Based on habitat mapping information, the study could consider nine possible study-site locations (Table 5.3-1).

**Table 5.3-1. Potential location and character of channel morphology study sites.**

| Stream | Potential Location | Character |
|---|---|---|
| Middle Yuba River | Below Oregon Creek in the vicinity of Freemans Crossing | Moderately and unconfined channel, ~1% gradient, alluvial and depositional. |
| | Above Oregon Creek | Steeper (>1% gradient), confined, more transport-dominated than below Oregon Creek, though some lateral cobble/gravel bar development. |
| | Below Our House Dam | Steeper (>1% gradient), confined, more transport-dominated bedrock control channel |
| | Above Our-House Dam, within influence of base level control effected by Our House Diversion | Low gradient (1.7% map gradient), depositional. |
| Oregon Creek | Vicinity of Celestial Valley | Confined 1.6% gradient, planar bedform, gravel-sized material in channel and on margins. |
| | Above Log Cabin Dam within influence of base level control effected by Log Cabin Diversion. | Confined ~1.8% map gradient. |
| North Yuba River | Below New Bullards Bar Dam. | Reach has very little accessibility due to vertical cliffs, and dominance of bedrock and boulders within channel. Large, immobile substrate, lateral and vertical controls by bedrock limits responsiveness to changes in inputs of sediment and to changes in hydrology. |
| Slate Creek | Within high water influence of New Bullards Bar | Confined, 2.4% map gradient. |
| Yuba River | Below New Colgate Powerhouse | Confined, less than 1%, cobble and boulder-dominated bed with very deep pools immediately below the Powerhouse, but increasing alluvial deposition as move downstream. |

One study site could potentially be selected in each location and, to the extent possible, each channel morphology study site ~~will~~ may be co-located with PHABSIM study sites. If it makes sense to co-locate a channel morphology cross section with a PHABSIM transect, it will be done. ~~The advantage of this is that PHABSIM study sites are usually in accessible areas and contain a range of habitat diversity represented in the reach. Data collected for the PHABSIM model is very similar to that needed for the sediment transport modeling and understanding floodplain inundation.~~ Study sites will be selected to mimic as closely as possible the gradient, width, and vegetation as the reach characteristics within the study area. Licensee will invite interested and available Relicensing Participants into the field to comment on the channel morphology study sites.

### 5.3.2 Step 2 – Data Collection

#### 5.3.2.1 Stream Cross Sections

All elevations will be surveyed by standard differential survey techniques using an auto-level or total station instrument. Headpin and tailpin elevations, water surface elevations (WSE), hydraulic controls, and above-water bed and bank elevations will be referenced to a temporary benchmark serving a single ~~transect~~cross section or ~~transect~~cross section~~transect or transect~~ cluster. Cross-sections ~~(also called "transects") established and measured for PHABSIM analysis~~ will include, at a minimum, the stage at twice the maximum bankfull depth (floodprone elevation). Every break in slope will form a vertical point on the graph, and what the breaks represent will be noted (e.g., top of bank, edge of floodplain, bankfull, extent of right or left bank that is "moveable"). The top of the rock elevation for bedrock within the channel, and the thalweg will be included. The thalweg will be assumed to be the minimum elevation below which the bed cannot erode, unless there are some other characteristics that suggest an alternative maximum scour depth at that cross section, which would then be estimated. Cross sections will be monumented with headpins and tailpins (e.g., rebar, pins in bedrock), benchmarks, and UTM coordinates.

~~No more than t~~Three-cross sections will be selected at any study site in which to measure the full suite of characteristics studied, except where collaboratively agreed to by Relicensing Participants in the field during site/cross section selection.~~.~~ ~~Where co-located, no more than three PHABSIM transects from Licensee's Instream Flow Study that represent the "area of interest" will be selected from approximately the middle of the study site.~~ Some ~~transect~~cross sections~~transects~~ may be surveyed across areas of possible sediment deposition ~~and potential spawning activities (i.e., glides, riffles and runs)~~, and where channel geometry (including bankfull and floodprone characteristics if they occur) is most representative of the reach, and representative of potential effects of the Project to site-specific aquatic habitat within the reach. The cross section ~~middle of the PHABSIM study~~ sites will be selected ~~preferentially because the~~in order to provide needed information for~~the~~ sediment transport analysis. Ssediment transport analysis needs three additional ~~transects~~ cross sections upstream and downstream to allow the model to stabilize and give accurate results at the area of interest. These three cross-sections upstream and downstream of the area of interest will be about 100 to 300 feet (ft) apart and be representative of study reach conditions. Upstream cross-sections will be far enough upstream from the area of interest that regimes being evaluated do not cause changes to the bed

profile at upstream boundary, but channel geometry is still representative of the study reach. If needed for sediment transport modeling purposes, Licensee will place additional cross-sections ~~within the PHABSIM study site~~ at major bed profile changes, valley width changes, tributaries, changes in roughness, structures, or gages.

Licensee will invite interested and available Relicensing Participants into the field to comment on the channel morphology ~~transect~~cross section~~transect~~ locations.

5.3.2.2 Stage-Discharge Relationship

For sediment transport modeling ~~(and PHABSIM),~~ calibration flows will be measured with the goal of achieving an even, logarithmic spacing of flows that allows for development of an adequate stage/discharge relationship sediment transport ~~(and PHABSIM hydraulic~~) model. Stage/discharge measurements will be obtained at no fewer than three discharges. When a stage/discharge measurement is taken, discharge through the study site will be measured using manual velocity meters or a combination of an acoustic Doppler and manual velocity meters at an appropriate cross section(s). ~~Tracer gravels will be used at each site and flow in order to calibrate the stage/discharge/incipient motion relationships.~~

5.3.2.3 Longitudinal Profile

A longitudinal profile will be done for each geomorphology study reach, measuring 20~~x~~ times the bankfull width, unless there is a major geomorphic change that limits the extent (e.g., waterfall). ~~that~~ It will include~~s~~ the six ~~transects~~ cross sections above and below the area of interest within the geomorphology study ~~PHABSIM~~ sites, the ~~PHABSIM transects~~cross sections~~site, the PHABSIM transects~~ in the area of interest, and any additional cross sections needed as stated in 5.3.3.1 above. ~~Transects~~ Cross sections ~~must be located within 0.2 mile of each other (i.e., survey will not exceed 0.2 mile). PHABSIM transects~~Cross sections~~transects~~ within runs, riffle, and glide-habitat will be selected preferentially~~; pools may be skipped~~. Benchmarks used in the instream flow PHABSIM analysis (often there is one benchmark established for each cross-section) will be "tied together" so that only the lowermost benchmark has an assumed elevation of 100 ft. Water surface, thalweg, floodplain, and bankfull elevations will be measured along the profile, making sure to include breaks in slope and each ~~transect~~cross section~~transect~~ location as a vertical.

5.3.2.4 Particle Size

Surficial substrate composition will be evaluated by compiling a facies map, which is delineation of the surface bed texture into distinct units by dominant and sub-dominant grain-size classes (Buffington and Montgomery 1999). Wolman (1954) pebble counts will be done across each ~~transect~~ cross section and for each textural facies. Particles will be measured using a gravel template, also known as a gravelometer, a square grain-size template, and a particle size distribution by number (not weight) will be created. If particles can not be lifted to pass through the gravelometer, size will be estimated using a ruler~~.~~.

Three exposed bars at each site will be evaluated to assess the relative difference between surface and sub-surface particles size (e.g., armoring). One-hundred particles will be measured in a 1 meter (m) enclosure, surface particles will be removed to the depth of the largest particle. Sub-surface particles will be mixed and 100 particles will be measured from the sub-surface. Ratio of surface to sub-surface particle size will be an indication of armoring. Low values of ~~$D_{50surface}$ :~~$D_{50surface}$:$D_{50subsurface}$ (e.g., less than 1.3 means relatively weak armoring) are generally indicative of relatively high mean annual sediment transport rates, whereas high values of $D_{50surface}$: $D_{50subsurface}$ (e.g., greater than 4 means relatively strong armoring) are generally indicative of relatively low mean annual sediment transport rates (Dietrich et al. 1989, Parker 2004).

5.3.2.5 Site Map

A site map sketch will be done of the surveyed reach and will include major features such as pools, riffles, bedrock outcrops, boulders, bridges, sediment deposits; location of cross sections; and substrate descriptions. Substrate will be separated into facies ("textural mapping"), given a textural type (Buffington and Montgomery 1999) and mapped. Grain size distribution of these textural patches will be measured with Wolman pebble counts (see Section 5.3.2.4) and area of each facies will be quantified.

5.3.2.6 Streambank Erosion Potential

Streambank erosion potential of each cross section for both left and right streambanks will be determined based on a "bank erosion hazard index" method developed by Rosgen (1996), that classifies reaches into categories of relative bank erosion potential (i.e., very low, low, moderate, high, very high, and extreme). Measured criteria include ratio of streambank height to bankfull stage, ratio of riparian vegetation rooting depth to streambank height, degree of root density, bank angle, and degree of bank surface protection.

5.3.2.7 Channel Stability

Channel stability will be rated using the Pfankuch (1975) method as modified by Rosgen (1996). The Pfankuch procedure "was developed to systemize measurements and evaluations of the resistive capacity of mountain stream channels to the detachment of bed and bank materials and to provide information about the capacity of streams to adjust and recover from potential changes in flow and/or increases in sediment production." (Pfankuch 1975). Channel stability will be used to assess the potential for lateral or vertical movement, in addition as input to the riparian condition assessment (Section 5.3.3.8).

5.3.2.8 Input of Sediment from Tributaries

~~Some of the~~ Ttributaries ~~may be adding~~naturally add~~adding~~ sediment to the Project reaches. The aerial video (HDR 2009) and maps will be used to assess if an alluvial fan exists at the junction of the tributaries, or to assess if there are other indications of sediment ~~input~~ build up from the tributaries. If the tributary junctions ~~is~~ are easily accessible, a qualitative field review will be made of the junction ~~if there are initial indicators from the aerial video that the tributary is a~~

~~sediment source.~~ Evaluation will include a discussion of the size and type of material delivered, the type of deposit, if any, an estimate of the physical extent of the deposit, the geology of the tributary, any known sediment sources, and an estimate of sediment yield based on regional estimates. There will be no quantitative sediment budget done, however. A discussion of the availability and fate of ~~sediment~~ bedload from tributaries will be included in the report.

5.3.2.9 Coordination with Licensee's Riparian Habitat Study Upstream of ~~-~~Englebright Reservoir

The assessment of the riparian zone in the channel morphology study sites will be conducted in close cooperation and collaboration with riparian and hydrology specialists. Licensee believes it will be beneficial to co-locate the channel morphology study sites with the study sites selected for Licensee's Riparian Habitat Upstream of Englebright Reservoir Study. At a minimum, existing data, including Geographic Information System (GIS) data, historical information, reports, maps, and aerial photography relevant to both channel morphology and riparian vegetation will be collected and reviewed where available for the selected sites.

5.3.2.10 Examine Effects of Uncontrolled Spill over Project Dams on Sediment Particle Size and Composition

History and magnitude of uncontrolled spill from Project dams will be summarized. Fate and distribution of sediment eroded from spill channels will be evaluated. Data collected during the site investigations (Sections 5.3.2.1-5.3.2.8) will be used in the analysis.

5.3.2.11 Examine Effects of New Colgate Powerhouse Tailrace on Channel Morphology and Sediment Distribution

The New Colgate Powerhouse discharges water into the Yuba River. The vicinity of the powerhouse release will be investigated for signs of erosion at the outflow and downstream on the channel banks. Since the backwater effect from the Englebright Reservoir is within 1.3 miles of the powerhouse, evidence of bank erosion, scour or extensive deposition that can be linked to that resulting from erosion and/or high magnitude discharges as a result of discharges from the tailrace will be investigated within this 1.3 mile area. Erosion, scour and deposition will be evaluated using the release history from New Colgate Powerhouse.

5.3.2.12 Large Woody Debris

Large woody debris data have been collected in Project reaches as part of the habitat mapping exercise (Attachment 3.10A to Instream Flow Study Proposal). Licensee records regarding quantity and fate of large woody debris removed from New Bullards Bar Reservoir, from Our House Dam, and from Log Cabin Dam will be summarized in Licensee's Pre-Application Document Section 7.1. Discussion of quantities of LWD found within the Project area will be included within the final study report, along with an analysis comparing to the quantities within Sierra Nevada streams of a similar form and location in the watershed.

### 5.3.3 Step 3 - Assess Sediment Mobility

The objectives of this component of the study are to evaluate discharges that mobilize particles that compose the channel bed and spawning gravel, and to assess how Project operations have affected the frequency of bed- and ~~gravel~~particle-mobilizing flows.

Surveyed cross-sections and longitudinal profiles will be used to develop a calibrated hydraulic model for each reach. The model will be used to estimate shear stress ($N/m^2$) at each ~~transect~~cross section~~transect~~ for a range of discharges. Hydraulic models will be constructed using the Hydraulic Engineering Center's River Analysis System (HEC-RAS, e.g., version 4.0 or 4.0.0) developed by the USACE (USACE 2006, 2008). Observed water surface elevations and discharges will be used to calibrate the hydraulic model to known stages. A rating curve developed from known stages and flows will be used as a downstream boundary condition of each model. Other hydraulic parameters used to calibrate the models are contraction and expansion ratios, and Manning's "n" roughness coefficient. If calibration is not possible using these parameters, thalweg elevations along the longitudinal profile will be used to interpolate new ~~transect~~cross sections~~transects~~ to improve model accuracy.

Bed shear stress (function of the hydraulic radius-slope product) is output from the hydraulic modeling. Bed shear stress ($\tau$) is expressed as an average force ($N/m^2$) over the ~~transect~~cross section~~transect~~ width. As output from HEC-RAS, a range of discharges (in cfs, X-axis) versus shear stress (in $N/m^2$, Y-axis) will be provided for each of the cross sections for which particle size analyses were done. In general, the HEC-RAS output parameter "Total Shear" will be used; this value represents the applied bed shear across the entire ~~transect~~cross section.~~transect.~~ In some cases, ~~transect~~cross sections~~transects~~ may have small side channels that should not be considered in the applied bed shear estimate. In these cases, the HEC-RAS bank stations will be adjusted to the extents of the main channel and the HEC-RAS output parameter "Channel Shear" will be used. Channel Shear only reports the applied bed shear stress for the main channel or the area between model bank stations.

Particle size analysis, developed by pebble counts, will be used to develop a particle size distribution for up to three cross sections in each study site. Critical shear stress ($\tau^*_{ci}$, the shear stress threshold at which incipient motion occurs) must be exceeded for particle movement to occur. Shield's relationship for critical shear stress is defined as $\tau^*_{ci} = \beta (\gamma_s - \gamma) D_x$, where $\beta$ = Shield's parameter (a dimensionless variable), $\gamma$ = specific weight of the fluid, $\gamma_s$ = specific weight of the sediment, and $D_x$ = median particle diameter of interest. The particles of interest will include ~~the largest particle in each of the five gravel classifications~~gravel and cobble sizes: 2,~~classifications:~~ 4, 8, 16, 32, ~~and~~ 64, and 128 mm~~mm~~ (Wentworth Scale, p. 20 Vanoni [ed.] 1975), and the $D_{16}$ (fine particles, or the particle diameter where 16 percent of the particles are finer), $D_{50}$ (median-size particles), and $D_{84}$ (coarse particles, or the particle diameter where 84 percent of the particles are finer) for each cross section. The Shield's parameter may vary from 0.02 to 0.086 with a common average value for gravel of about 0.046 (Miller et al. 1977; Buffington and Montgomery 1997, Mueller et al. 2005). A range of Shield's parameters (0.03, 0.045, and 0.060) will be used in the critical shear stress calculation to show the sensitivity to the Shield's parameter, and to be able to discuss the changes in mobility due to the differences in gradient within the reach, between the meso-habitat units, and between regulated and unimpaired

flows. Critical shear for specific particles can then be compared against the bed shear/discharge relationship; when bed shear exceeds critical shear, particles can be mobilized

Flow exceedance values and recurrence intervals will be presented using the best available flow data under regulated and unimpaired conditions (e.g., modeled regulated or unimpaired daily annual maximum values). Exceedance flows are the percentage of time certain flows are met or exceeded (i.e., 25 percent exceedance represents a "high" flow as this is the flow that is met or exceeded only 25 percent of the time, and 50 percent exceedance represents the median flow). ~~Flow recurrence intervals (which is~~Flow recurrence intervals (which are~~is~~ the inverse of the flow exceedance) will be calculated using the PeakFQ statistical program developed by the USGS based on Bulletin 17B (USGS 1982). Results of the hydrologic models and PeakFQ analysis will be provided as tables that show recurrence interval (year) and the Bulletin 17B discharge estimate (cfs). For any given flow (which has an exceedance value/recurrence interval under regulated and unimpaired conditions), the critical shear of any particle can be seen to be above or below the bed shear for that cross section. If it is below the bed shear, the particle is probably not mobile; if it is above, mobility is more likely.

### 5.3.4 Step 4 - QA/QC Data

Following data collection, all data will be subject to quality assurance/quality control (QA/QC) procedures including, but not limited to: 1) checking field data sheets against entered data to be sure no corrections are needed; and 2) independent review of hydraulic and sediment transport models, 3) reviewing data and report for completeness. The datasets will also be reviewed graphically to check for errors.

### 5.3.5 Step 5 – Analyze Data

The goal of the study is to quantify or characterize river form and process and interaction with the riparian zone. Table 5.3-2 presents the relationship between potential channel morphology issues, data to be collected by this study, and data analysis that will occur as part of this study.

**Table 5.3-2. Relationship between perceived channel morphology issues, data to be collected by this study, and data analysis that will occur as part of this study.**

| Issue | Data | Analysis |
|---|---|---|
| Project effects on channel morphology and channel condition below Project facilities | • Longitudinal profile<br>• Cross sections<br>• Substrate<br>• Stage-discharge relationship<br>• Hydrologic information – regulated and unimpaired<br>• Age and function of riparian zone<br>• Storage in reservoirs compared to regional/local sediment yield values<br>• Channel and bank stability<br>• Review of historical aerial photographs<br>• Sketch map<br>• Sediment mobility | • Longitudinal profile and cross sections will be used in the sediment transport model to estimate bed shear. Critical shear for specific particle sizes data can be calculated and used with the graph of bed shear to show the discharges where critical shear exceeds bed shear. Flow exceedance tables show the recurrence interval of flows under regulated and unimpaired conditions. Combining all the tools provides an estimate of flows that mobilize particles and the frequency of those flows under different operating conditions.<br>• Stage-discharge relationship provides at what flow various surfaces in the riparian zone are inundated; combined with hydrology data provides the frequency of inundation for regulated and unimpaired conditions.<br>• Age and function of riparian zone provides a history of disturbance and role of riparian zone in shape and form of channel.<br>• Regional/local sediment yield and estimates of storage within Project diversions and reservoirs provides an estimate of the change in sediment availability (e.g., S* - Grant *et al.* 2003)<br>• Assessment of channel and bank stability provides how likely the channel is to move from its current form<br>• Historical photos show the relationship of current form and prior form (depending upon the photos available)<br>• Sketch map provides context for assessment, and provides a facies map that provides a template for stratifying other physical and biological measurements. |
| Project effects on floodplains | • Cross sections<br>• Stage-discharge relationship<br>• Hydrologic information<br>• Age and function of riparian zone<br>• Historical aerial photographs | • Cross sections provide the location and elevation of bankfull, depositional surfaces, and floodplains.<br>• Stage-discharge relationship provides at what flow various surfaces are inundated; combined with hydrology data provides the frequency of inundation for regulated and unimpaired conditions.<br>• Age and function of riparian zone provides the history of floodplain development and role vegetation plays in the history, development and future of the channel.<br>• Historical photos show the history and interaction of the active channel with floodplains, conversion to or from terraces; changes in vegetation; disturbance history. |

**Table 5.3-2. (continued)**

| Issue | Data | Analysis |
|---|---|---|
| Project effects on bedload distribution | • Textural facies mapping, Wolman pebble counts<br>• Channel armoring<br>• Evaluation of tributary inputs of sediment.<br>• Evaluation of influence of diversions and reservoir level.<br>• ~~Wolman pebble counts~~ | • Textural mapping, quantified by Wolman pebble counts, yields a visual record of channel conditions, and provides an areal weighting of grain sizes.<br>• Ratio of surface to sub-surface particles provides an armoring ratio. Surface layer is commonly coarser than the sub-surface, and the size distribution of the sub-surface gravel is often similar to that of the transported bedload. Low values of $D_{50surface}$ :$D_{50subsurface}$ (e.g., less than 1.3 means relatively weak armoring) are generally indicative of relatively high mean annual sediment transport rates, whereas high values of $D_{50surface}$ : $D_{50subsurface}$ (e.g., greater than 4 means relatively strong armoring) are generally indicative of relatively low mean annual sediment transport rates.<br>• Discussion of tributary input of sediments and fate within the Project streams.<br>• Discussion of base level control on Slate Creek, Oregon Creek upstream of Log Cabin Diversion, and Middle Yuba upstream of Our House Diversion.<br>~~Analysis of T*/S* distribution (Grant etal)~~<br>• ~~Matrix showing incipient motion flow/partical size per reach.~~ |
| Project effects on LWD | • Habitat mapping LWD data (Attachment 3.10A to Instream Flow Study Proposal)<br>• Licensee summary of history and fate of LWD removed from reservoir and diversions | • Discussion of quantity of LWD within Project reaches compared to similar Sierra Nevada streams. |
| Project effects on particle size and composition from dam release outlets, minimum flow, uncontrolled spill | Summary of spill history | • Discussion of channel form, sediment size and distribution as it relates to hydrology created by releases from dam outlets and minimum flow releases flow, and erosion and/or hydrology due to spill releases from Project dams |
| Project effects on channel morphology and sediment distribution from releases from New Colgate Powerhouse | • Bank erosion assessment below New Colgate PH<br>• Assessment of scour and deposition below New Colgate PH<br>• Flow release history from New Colgate PH. | • Discussion of erosion, scour, and deposition using flow release history for New Colgate Powerhouse. |

### 5.3.6 Step 6 – Prepare Report

At the conclusion of the study, YCWA 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 include the following attachments:

- Scanned field data (*.PDF format) of cross sections, longitudinal profiles, sketch maps, and particle size measurements. Raw data may be made available to Relicensing Participants prior to the publishing of the final study report upon request, and if Licensee has completed its QA/QC review of the data.
- For each geomorphic study site, data associated with each of the geomorphic parameters will be shown in a tabular format.
- Maps showing study site and ~~transect~~cross section~~transect~~ locations.
- Photo-documentation and UTM coordinates of ~~transect~~cross sections~~transects~~; UTM coordinates of longitudinal profile downstream and upstream limits.
- ~~Transect~~Cross sections~~Transects~~ and longitudinal profiles will be graphically plotted, with bankfull and flood prone widths identified.
- Pebble counts for up to three ~~transect~~cross sections~~transects~~ per study site will be graphically plotted as cumulative particle size distribution curves.
- The hydraulic/sediment transport model input and output files.
- Table showing the critical shear stress ($N/m^2$) for gravels (4, 8, 16, 32, 64 mm), and the $D_{16}$, $D_{50}$, and $D_{84}$ for each ~~transect~~cross section~~transect~~ using Shield's parameters of 0.03, 0.045, and 0.060.
- Graphs presenting shear stress ($N/m^2$) versus discharge (cfs) for each ~~transect~~cross section~~transect~~ (up to three ~~transect~~cross sections~~transects~~ per study site).
- ~~Table showing T*/S* for each reach~~
- Flow exceedance tables under regulated and unimpaired conditions.
- Summary of riparian condition.

## 6.0 Study-Specific Consultation

The study includes one study-specific consultation:
Licensee will invite interested and available Relicensing Participants into the field to comment on the channel morphology study sites and the ~~transect~~cross section locations. During field selection of cross sections, number and location of cross sections may be modified by Relicensing Participants who are present~~transect locations~~.

## 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 September 16, 2011 and the study is not disputed by a mandatory conditioning agency~~October 4, 2011~~:

Study Site and ~~Transect~~ Cross Section Selection .....October 2011
Field Work ..... April - August~~September~~ 2012

Data Entry, QA/QC, & Analysis.....July - AugustSeptember 2012
Report Preparation .....July – SeptemberOctober 2012

# 8.0 Consistency of Methodology with Generally Accepted Scientific Practices

Geomorphology studies are common to hydroelectric relicensing projects to determine channel condition, and determine whether flow or sediment measures are necessary and/or whether channel restoration is necessary. Field methods have been used recently in other California relicensing efforts. Determination of shear stress versus discharge is discussed for HEC RAS model use (Brunner 2008, USACE 1989 and 1981).

# 9.0 Level of Effort and Cost

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

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Study 2.3

# WATER QUALITY

February 11, 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 water quality. Hydroelectric facilities control the timing and magnitude of flow delivered to stream channels and residence time of water within Project impoundments; these hydrologic factors define the physical, chemical and biological characteristics of water within the Yuba River watershed.

Water temperature is not addressed in this study but in two separate studies: Water Temperature Monitoring and Water Temperature Modeling. Additionally, consistency of water quality with methylmercury fish tissue objectives is addressed in a separate study: Bioaccumulation.

## 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 Study Goals and Objectives

The goals of this study are: 1) to characterize existing water quality conditions in Project reservoirs and Project-affected reaches of the North, Middle and mainstem Yuba rivers and tributaries including Oregon Creek, 2) to determine consistency with state and federal water quality objectives, standards, and criteria, and 3) to identify potential Project O&M related causes for Basin Plan Objectives and Beneficial Use protections to not be met.

The objective of the study is to collect water quality data adequate to meet the study goals.

# 4.0 Existing Information and Need for Additional Information

Available information consists of existing regulatory plans and advisories for the watershed, as well as water quality data collected to date in the project area.

## 4.1 Regulatory Status for Surface Water and Fish the Project Area

### 4.1.1 The Basin Plan

Water Quality Objectives and Beneficial Use Designations for Project reservoirs and Project affected stream reaches are established in Central Valley Regional Water Quality Control Board's (CVRWQCB) *Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin Rivers*, the fourth edition of which was initially adopted in 1998 and most recently revised in 2007 (CVRWQCB 1998). The Yuba River Development Project and the area downstream of the Project falls within two Basin Plan Hydro Units: Hydro Unit 517, which includes New Bullards Bar Reservoir, and Hydro Unit 515.3, which includes the Yuba River from the United States Army Corp of Engineers' (USACE) Englebright Dam to the Feather River. Designated beneficial uses of surface water were excerpted from the Basin Plan and are shown by Hydro Unit in Table 4.1.1-1.

**Table 4.1.1-1. Beneficial uses of surface water within the Yuba River Development Project and the area downstream as designated by Hydro Unit (HU) in the Basin Plan (CVRWQCB 1998).**

| Designated Beneficial Use Description from Basin Plan, Section II | | Designated Beneficial Use by Hydro Unit from Basin Plan, Table II-1 | | |
|---|---|---|---|---|
| | | Use | Sources to USACE's Englebright Reservoir | USACE's Englebright Dam to Feather River |
| | | | HU 517 | HU 515.3 |
| Municipal and Domestic Supply (MUN) | Uses of water for community, military or individual water supply systems including, but not limited to, drinking water supply. | MUNICIPAL AND DOMESTIC SUPPLY | Existing | -- |
| Agricultural Supply (AGR) | Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing. | IRRIGATION | Existing | Existing |
| | | STOCK WATERING | Existing | Existing |
| Industry | Uses of water for industrial activities that depend primarily on water quality. | INDUSTRIAL PROCESS SUPPLY (PROC) | -- | -- |
| | Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization. | INDUSTRIAL SURVICE SUPPLY (IND) | -- | -- |
| | Hydropower generation | POWER (POW) | Existing | Existing |
| Water Contact Recreation (REC-1) | Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs. | CONTACT | Existing | Existing |
| | | CANOEING AND RAFTING* | Existing | Existing |

**Table 4.1.1-1. (continued)**

| Designated Beneficial Use Description from Basin Plan, Section II | | Designated Beneficial Use by Hydro Unit from Basin Plan, Table II-1 | | |
|---|---|---|---|---|
| | | Use | Sources to USACE's Englebright Reservoir | USACE's Englebright Dam to Feather River |
| | | | HU 517 | HU 515.3 |
| Non-Contact Water Recreation (REC-2) | Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beach-combing, camping, boating, tide-pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities. | OTHER NON-CONTACT | Existing | Existing |
| Freshwater Habitat | Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates. | WARM[1,2] | -- | Existing |
| | Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates. | COLD[1,2] | Existing | Existing |
| Migration of Aquatic Organisms (MGR) | Uses of water that supports habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish. | WARM[2,3] | -- | Existing |
| | | COLD[2,4] | -- | Existing |
| Spawning (SPWN) | Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish. | WARM[2,3] | -- | Existing |
| | | COLD[2,4] | Existing | Existing |
| Wildlife Habitat (WILD) | Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation or enhancement of terrestrial habitats or wetlands, vegetation, wildlife (*e.g.*, mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources. | WILDLIFE HABITAT | Existing | Existing |

[1] Resident fish; does not include anadromous.
[2] Any hydrologic unit with both WARM and COLD beneficial use designations is considered COLD water bodies for the application of water quality objectives (CVRWQCB 1998).
[3] Striped bass, sturgeon and shad.
[4] Salmon and steelhead.
* Canoeing and rafting are flow-dependent beneficial uses.

## 4.1.2 California's List of Impaired Waters

Section 303(d) of the Clean Water Act (CWA) requires that every two years each State submit to the United States Environmental Protection Agency (EPA) a list of rivers, lakes and reservoirs in the State for which pollution control or requirements have failed to provide for water quality. The CVRWQCB and State Water Resources Control Board (SWRCB) work together to research and update the list for the Central Valley region of California. Based on a review of this list and its associated Total Maximum Daily Load (TMDL) Priority Schedule, in the Project Vicinity, USACE's Englebright Reservoir has been identified by the SWRCB as CWA §303(d) State Impaired for mercury; and Deer Creek, a tributary to the Yuba River, has been identified as impaired for pH (SWRCB 2006). However, there are currently no approved TMDL plans for the Yuba River.

In 2009, the CVRWQCB recommended including additional surface waters in the Project Area to the 303(d) list as impaired for mercury: New Bullards Bar Reservoir, the Middle Yuba River,

the North Fork Yuba River from New Bullards Bar Dam to Englebright Reservoir, the South Yuba River from Lake Spaulding to USACE's Englebright Reservoir, and the Lower Yuba River from USACE's Englebright Reservoir to the Feather (CVRWQCB 2009). The CVRWQCB is also recommending that the lower Yuba River be added to the 303(d) list as impaired for iron (CVRWQCB 2009). These recommendations were considered and adopted by the SWRCB at the August 3, 2010 Board meeting, at which time they were advanced forward for approval by the United States EPA (Azimi-Gaylon, pers. comm., 2010). At the time this study proposal is prepared, they have not bee approved by the EPA.

### 4.1.3 Fish Ingestion Advisories

Using available fish tissue data and risk-based methodologies, the Office of Environmental Health Hazard Assessment (OEHHA) has issued species-specific fish ingestion advisories for trout, sunfish and bass caught in USACE's Englebright Reservoir (OEHHA 2003, OEHHA 2009). Fish ingestion advisories previously issued for Deer Creek, a tributary to the Yuba River, were recently retracted due to an insufficient quantity of data (OHHEA 2009).

## 4.2 Existing Water Quality Information

Existing, relevant and reasonably available information found at the Project Area[1] was documented in Section 7.2.9 of the Licensee's ~~-~~Pre-Application Package (YCWA 2010) and is summarized below.

### 4.2.1 Licensees' Summer 2009 Data

Information regarding water quality in the Project Area was gathered during the low flow summer season in 2009, a period when Project O&M effects were expected to be most pronounced, if they occur. The study consisted of two elements: a general water quality element and a recreation element. The general water quality element consisted of collecting samples from the reservoirs and stream reaches of the Project Area and analyzing each sample for 35 analytes. Secchi disc measurements were also made within reservoirs. The recreation study element consisted of collecting samples adjacent to New Bullards Bar Reservoir's Emerald Cove and Dark Day Campground boat ramps on five separate days over a 30 day period that included the Labor Day weekend. Bacteria counts were made for these samples.

Surface water samples were collected from the 17 locations between September 14 and 17, 2009. Temperatures ranged between 8.8 to 16.1 degrees Centigrade (°C) at all locations except upstream of the Project near the South Yuba River State Park, which had a temperature of 20.9°C. Dissolved oxygen (DO) was generally between 7.3 and 9.5 milligrams per liter (mg/L), while pH~~ph~~ ranged between 7.3 and 8.3 standard units (su) in all 17 samples. Turbidity ranged from non-detect to 15.4 Nephelometric Turbidity Units (NTU) and hardness ranged from 21 to

[1] For the purposes of this document, the Project Area is defined as the area within the Federal Energy Regulatory Commission (FERC) existing Project Boundary and the land immediately surrounding the FERC Project Boundary (i.e., within about 0.25 mile of the FERC Project Boundary) and includes Project-affected reaches between facilities and downstream to the next major water controlling feature or structure.

90 mg/L. The Secchi disc measurement for New Bullards Bar was 9 feet and for USACE's Englebright Reservoir, the Secchi disc depth was 12 feet. Below and within Project facilities, metals and dissolved metals concentrations were either non-detect using laboratory methods or present in trace amounts. Metals concentration in Project surface water met both drinking water standards and aquatic life protective criteria.

Fecal coliform and *Escherichia coli* (*E. coli*) were not found, while total coliform was found. Fecal coliform is the only one of these parameters for which there is a Basin Plan Objective. Since total coliform counts were not accompanied by commensurate *E. coli* counts, it is likely that humans are not responsible for the observed total coliform.

### 4.2.2 Sacramento River Watershed Program 1996-1998

The Sacramento River Watershed Program collected 27 samples over a 3-year period between 1996 and 1998 from a site near Marysville, directly upstream of the Yuba River's confluence with the Feather River (LWA 2000 *IN* YCWA, CWDR, and BOR 2007). In this program, pH ranged from 7.0-7.8 su, turbidity ranged from 1-153 NTU, DO ranged from 8.0-12 mg/L, Total Organic Carbon (TOC) ranged from 0.7-2.4 mg/L, nitrate-nitrite concentrations ranged from 0.05-0.14 mg/L, and electrical conductivity (EC) ranged from 44-105 microSeimens per centimeter (µS/cm). Samples were also analyzed for mercury (total; 1.19-46.7 nanograms per Liter, or ng/L). Samples collected in the earliest rounds were also analyzed for seven trace metals which were taken off the anlayte list after metal concentrations were found to be consistently below drinking water criteria (LWA 2000).

### 4.2.3 Oroville Relicensing Water Quality Study 2002-2004

In support of the Oroville Dam relicensing effort, the California Department of Water Resources (CDWR) collected 30 samples from a Feather River site near Marysville, directly upstream of the Yuba River's confluence with the Feather River (DWR 2004 *IN* HDR|SWRI 2007). DWR analyzed each sample for more than 50 analytes, including total and dissolved metals. In the DWR samples, pH ranged from 7.1-7.4 su; turbidity ranged from 0.5-17.2 mg/L; DO ranged from 8.4-14.2 mg/L; TOC ranged from 0.8-3.6 mg/L; nitrate-nitrite concentrations ranged from less than 0.01-0.08 mg/L; and EC ranged from 76-28 µS/cm.

### 4.2.4 South Yuba River Citizens League (SYRCL) 2000-2009

Since 2000, as weather and access have allowed, the South Yuba River Citizens League (SYRCL), a non-governmental organization, has implemented a citizen's monitoring program, funded by a grant sponsored by the Regional Water Quality Control Board (RWQCB). The program consists of sampling up to 33 sites in the Yuba River watershed for dissolved oxygen, pH, conductivity, temperature, turbidity, total suspended solids, and some metals (arsenic, mercury), sometimes as often as monthly. Based on these data, SYRCL has identified arsenic, bacteria, and mercury as constituents of concern in the watershed (SYRCL 2006; SYRCL Website 2005 *IN* HDR|SWRI 2007).

Upstream of the Project, surface water samples were collected from the North Yuba River just upstream of New Bullards Bar Reservoir during an 8 to 12-month period in 2001 (SYRCL 2007 *IN* HDR|SWRI 2007). A total of seven samples were collected for six general water quality parameters: pH ranged from 7-8.1 su, turbidity ranged from 0-45 mg/L, DO ranged from 8.3-12.3 mg/L, TOC ranged from 0.59-2.6 mg/L, nitrate-nitrite ranged from 0.025-0.05 mg/L, and EC ranged from 20-30 µS/cm. In the Project Area, SYRCL has been sampling downstream of Colgate Powerhouse, measured constituents consisted of pH (6.8-8.6 su), DO (9.5-14.5 mg/L), temperature (7.1-18.4 C), turbidity (0-16.6 NTU), and electrical conductivity (60-143 µS/cm).

Between 2001 and 2009, SYRCL collected samples from three locations downstream of USACE's Englebright Reservoir to the Feather River confluence, Parks Bar at Highway 20, Hallwood Avenue, and Marysville above the confluence with the Feather River (SYRCL 2009). Samples were analyzed at different frequencies and results were as follows: coliform ranged from 42 to greater than 2,410 MPN/100 ml; arsenic ranged from non-detect in laboratory analysis to 3.9 mg/L; iron ranged from non-detect to 2360 mg/L; copper ranged from 1.06-19 mg/L; zinc ranged from 0.4-13.6 mg/L; chromium ranged from non-detect to 0.94 mg/L; and turbidity ranged from non-detect to 27 mg/L.

### 4.2.5 Need for Additional Data

Historic data suggest that surface water of the Project Area generally meets Basin Plan Objectives. However, the vast majority of historic data is 10 years old or more, much of it has been collected near the mouth of the Yuba River, and Licensee's 2009 data was collected only in one season – summer low flow period. Data collection efforts throughout project affected streams and impoundments during the spring runoff would be useful, as would water quality information from additional sites during the summer low flow period and downstream of New Bullards Bar reservoir in the fall.

# 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 Bullards Bar Dam Reservoir to the confluence with the Middle Yuba River, and 4) and the portion of the Yuba River from the confluence of the North and Middle Yuba rivers to the Feather River, including USACE's Englebright Reservoir. Background conditions will be collected from sites upstream of all Project facilities.

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 (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.

## 5.3 Methods

The study will be performed in eight steps: 1) select water quality parameters; 2) select sampling locations; 3) collect water samples; 4) perform laboratory analyses using standard methods adequately sensitive to determine consistency with state and federal water quality standards; 5) prepare quality assurance/quality control (QA/QC) review; 6) determine consistency with Basin Plan Objectives and beneficial use protection needs; 7) consult Operations Staff; and 8) prepare report. The report will be made available to Relicensing Participants. Each of these steps is described below.

### 5.3.1 Step 1 - Select Water Quality Parameters

For the purpose of this study proposal, water quality parameters to be measured are divided into two categories: 1) general water quality and 2) recreation. The parameters included in each category and associated information are listed in Table 5.3.1-1.

**Table 5.3.1-1. Water quality parameters to be measured and methods, reporting limits and laboratory holding times for each.**

| | Analyte | | Method | Target Reporting Limit µg/L (or other) | Hold Time |
|---|---|---|---|---|---|
| GENERAL STUDY | **BASIC WATER QUALITY- IN SITU** | | | | |
| | Dissolved Oxygen | DO | SM 4500-O | 0.1 mg/L | Field |
| | Specific conductance | -- | SM 2510A | 0.001 µmhos | Field |
| | pH | -- | SM 4500-H | 0.1 su | Field |
| | Turbidity | -- | SM 2130 B | 0.1 NTU | Field |
| | Secchi Disc | -- | -- | -- | Field |
| | **BASIC WATER QUALITY—LABORATORY** | | | | |
| | Total Organic Carbon | TOC | SM 5310 | 0.2 mg/L | 28 d |
| | Dissolved Organic Carbon | DOC | EPA 415.1 D | 0.5/0.1 | 28 d |
| | Total Dissolved Solids | TDS | EPA 2540 C SM 2340 C | 1 mg/L | 7d |
| | Total Suspended Solids | TSS | EPA 2520 D SM 2340 D | 1 mg/L | 7d |
| | **INORGANIC IONS** | | | | |
| | Total Alkalinity | -- | SM 2340 B | 2000 | 14 d |
| | Calcium | Ca | EPA 6010 B | 30 | 180 d |
| | Chloride | Cl | EPA 300.0 | 20 | 28 d |
| | Hardness (measured value) | -- | EPA 2340 B SM 2340 C | 1 mg/L as $CaCO_3$ | 14 d |
| | Magnesium | Mg | EPA 6010 B | 1 | 180 d |
| | Potassium | K | EPA 6010 B | 500 | 180 d |
| | Sodium | Na | EPA 6010 B | 29 | 180 d |
| | Sulfate | $SO_4^{2-}$ | EPA 300.0 | 1.0 mg/L | 28 d |
| | Sulfide | $S^{2-}$ | SM 4500 S2 - D | 0.05 mg/L | 28 d |
| | **NUTRIENTS** | | | | |
| | Nitrate-Nitrite | -- | EPA 300.0 | 2 | 28 d <pH 2 |
| | Total Ammonia as N | -- | EPA 4500-NH3 SM 4500-NH3 | 0.02 | 28 d <pH 2 |
| | Total Kjeldahl Nitrogen as N | TKN | SM 4500 N | 100 | 28 d <pH 2 |
| | Total phosphorus | TP | SM4500 P | 20 | 28 d <pH 2 |
| | Dissolved Orthophosphate | $PO_4$ | EPA 365.1 EPA 300.0 | 0.01 | 48 h at 4 °C |
| | **METALS (total and dissolved)** | | | | |
| | Aluminum (total and dissolved) | Al | EPA 200.8/EPA 1638 | 4.0/ 0.4 | 180 d |
| | Arsenic (total and dissolved) | As | EPA 200.8/1638 | 0.15/0.04 | 180 d |

**Table 5.3.1-1. (continued)**

| | Analyte | | Method | Target Reporting Limit µg/L (or other) | Hold Time |
|---|---|---|---|---|---|
| GENERAL STUDY (continued) | Cadmium (total and dissolved) | Cd | EPA 200.8/1638 | 0.020/0.004 | 180 d |
| | Chromium, Total (total and dissolved) | Cr | EPA 200.8/1638 | 0.010/0.03 | 180 d |
| | Copper (total and dissolved) | Cu | EPA 200.8/1638 | 0.10/0.01 | 180 d |
| | Iron (total and dissolved) | Fe | EPA 200.8/1638 | 10.0/3.2 | 180 d |
| | Lead (total and dissolved) | Pb | EPA 200.8/EPA 1638 | 0.040/0.003 | 180 d |
| | Mercury (total) | Hg | EPA 1631 | 0.0005/0.00008 | 28 d |
| | Methylmercury (total and dissolved) | $CH_3Hg$ | EPA 1630 | 0.00005/0.000019 | 90 d |
| | Nickel (total and dissolved) | Ni | EPA 200.8/1638 | 0.10/0.01 | 180 d |
| | Selenium (total) | Se | EPA 200.8/1638 | 0.60/0.19 | 180 d |
| | Silver (total and dissolved) | Ag | EPA 200.8/1638 | 0.20/0.006 | 180 d |
| | Zinc (total and dissolved) | Zn | EPA 200.8/1638 | 0.2/0.1 | 180 d |
| RECREATION? STUDY | **BACTERIA** | | | | |
| | Total coliform | -- | SM 9221 | 1.1 MPN | 24 h |
| | Fecal coliform | -- | SM 9221 | 1.1 MPN | 24 h |
| | Escherichia coli | *E. coli* | SM 9223 | 1.1 MPN | 24 h |
| | **PETROLEUM HYDROCARBONS** | | | | |
| | Total Petroleum Hydrocarbons (gasoline range) | TPH-g | SW 8015B | 50 | 14 d |
| | Oil & Grease | O&G | Visual Observation | -- | -- |

Key:
EPA = United States Environmental Protection Agency
$CaCO_3$ = Calcium carbonate
d = days
h = hours
µmhos = micro-ohms
µg/L = micrograms per liter (equals parts per billion)
mg/L = milligrams per liter (equals parts per million)
MPN = Most Probable Number
NTU = Nephelometric Turbidity Units
SM = Standard Method
su = Standard Unit

## 5.3.2 Step 2 – Select Sampling Locations

### 5.3.2.1 Select General Water Quality Sample Locations

General water quality samples will be collected upstream and downstream of the Project reservoir, diversions and powerhouses. Samples will also be collected downstream of Project facilities at multiple sites between USACE's Englebright Reservoir and the Feather River. In New Bullards Bar Reservoir and in the USACE's Englebright Reservoir samples will be collected at a minimum of three sites each, including the deepest part of the reservoir near the dams. At each reservoir location, general water chemistry samples will be collected for laboratory analysis at two depths: within the hypolimnion and just below the surface in the epilimnion (Table 5.3.2-1).

**Table 5.3.2-1. General water quality sample Locations - reservoirs.**

| Reservoir | Sample Depth | Location |
|---|---|---|
| **NORTH YUBA RIVER** | | |
| New Bullards Bar Reservoir | Surface | Three Sites: 1) Near Madrone Cove, 2) Mid-Reservoir at influence of Slate Creek, and 3) Near Dam |
| | Bottom | |

**Table 5.3.2-1. (continued)**

| Reservoir | Sample Depth | Location |
|---|---|---|
| **YUBA RIVER** | | |
| USACE's Englebright Reservoir | Surface | Three Sites: 1) Upper reservoir, 2) Mid-Reservoir, and 3) Near Dam |
| | Bottom | |

Stream samples for general water quality will be collected upstream and downstream of New Bullards Bar Reservoir and USACE's Englebright Reservoir, ~~and~~ as well as at four locations between USACE's Englebright Dam and the Feather River (Table 5.3.2-2). Water chemistry samples will be grab samples collected for laboratory analysis from the moving water.

**Table 5.3.2-2. General water quality sample locations - stream reaches.**

| Stream Reach | Sample Depth | Location | Notes |
|---|---|---|---|
| **MIDDLE YUBA RIVER** | | | |
| -- | Surface | Above Our House Dam Diversion | Above New Bullards Bar Inflow SYRCL Sampling Site |
| Our House Diversion Dam Reach | Surface | Below Our House Dam Diversion | Immediately downstream of dam |
| | Surface | MYR upstream of confluence with NYR | MYR and Oregon Creek conditions |
| **OREGON CREEK** | | | |
| -- | Surface | Above Log Cabin Diversion Dam | Immediately upstream of the impoundment and above inflow from tunnel |
| Log Cabin Diversion Dam Reach | Surface | Below Log Cabin Diversion Dam | Immediately downstream of dam |
| **NORTH YUBA RIVER** | | | |
| -- | Surface | Below Fiddle Creek at Hwy 49[1] | SYRCL Sampling Site |
| New Bullards Bar Dam Reach | Surface | Below New Bullards Bar Dam | -- |
| **YUBA RIVER** | | | |
| -- | Surface | Above Colgate Powerhouse | SYRCL Sampling Site |
| Colgate Powerhouse Reach | Surface | Below Colgate Powerhouse | -- |
| | Surface | Downstream of Dobbins Ck/ upstream of SYR confluence & high-water line of Englebright Reservoir | Mixing of Dobbins with New Bullards/Colgate flow in Yuba |
| **SOUTH YUBA RIVER** | | | |
| -- | Surface | South Yuba River State Park – SYR upstream of Englebright high-water line | SYR delivery conditions from Yuba-Bear and Drum-Spaulding Projects; and routing; SYRCL's Bridgeport sampling site |
| **YUBA RIVER** | | | |
| -- | Surface | Narrows #2 Tailrace/ Below USACE's Englebright Dam | -- |
| Narrows 2 Powerhouse Reach | Surface | Below Deer Creek at Hwy 20 | SYRCL Sampling Site |
| Daguerre Point Dam Reach | Surface | Below USACE's Daguerre Point Diversion Dam | SYRCL Sampling Site |
| | Surface | At Walnut Avenue | -- |
| | Surface | Marysville | SYRCL Sampling Site |

[1] Or, if water levels are low, a location in flowing water upstream of the reservoir
[2] A location near the head of the reservoir.

Key:
Hwy = Highway
MYR = Middle Yuba River
SYR= South Yuba River
SYRCL= South Yuba River Citizens League
USACE= United States Army Corps of Engineers

### 5.3.2.2 Select Reservoir Recreation Water Quality Sample Locations

Two recreation water quality samples will be collected, one each from the surface of New Bullards Bar Reservoir near the boat ramps in Emerald Cove and~~a~~ Dark Day Campground (Table 5.3.2-3).

**Table 5.3.2-3. Recreation water quality sample locations--reservoir.**

| Reservoir | Sample Depth | Location |
|---|---|---|
| **NORTH YUBA RIVER** | | |
| New Bullards Bar Reservoir | Surface | Emerald Cove Near the Boat Ramp |
| | Surface | Dark Day Cove equidistant between~~Near~~ the Boat Ramp and the informal day use area.[1] |

[1] New Bullards Bar does not have any beaches, due to the reservoir's steep shoreline. However, at low water levels, the exposed shoreline near Dark Day Cove boat ramp is more gently sloped and recreationists have been observed swimming at this location.

If Licensee and Relicensing Participants collaboratively identify~~identifies~~ additional locations of concern regarding Project-related bacteria ~~in New Bullards Bar Reservoir~~ during the Recreation Use and Visitor Surveys Study (Study 8.1),~~,~~ additional recreation-related bacteria sampling will be performed at those locations.

### 5.3.3 Step 3 – Collect Samples

All data will be acquired in accordance with standard quality assurance practices.

### 5.3.3.1 General Water Quality Reservoir and Stream Sampling

Water chemistry samples will be collected from all locations in the spring run-off period (June/July) and late summer low flow season (late August/early September). A single sample will be collected downstream of New Bullards Bar for a third time, in the fall (October/November). Licensee will make a good faith effort to keep Relicensing Participants informed of the study's progress and preliminary findings following data QA/QC.~~).~~

#### 5.3.3.1.1 In Situ Sampling

*In situ* water quality measurements will be made at these same depths with a Hydrolab DataSonde 5 (Hydrolab), or other instrument with similar precision and accuracy. Water temperature (±0.1°C), DO (±0.2 mg/L), pH (±0.2 standard unit, or su), specific conductance (±0.001 micromhos per centimeter (µomhos/cm)), and turbidity (± 1 NTU) will be measured *in situ* using a Hydrolab DataSonde 5 or other similar instrument that has the same precision and accuracy. Prior to and after each use, the instrument will be calibrated using manufacturer's recommended calibration methods. Any variances will be noted on the field data sheet and final report and recalibration or repair done as necessary. Licensee will note relevant conditions during each sampling event on the field data sheet (i.e., air temperature, flow, description of location, floating material, evidence of oil and grease, and activities in the vicinity of sampling site that could cause short or long term alterations to water quality, such as dredging).

#### 5.3.3.1.2 Laboratory Samples

Each laboratory sample will be collected into laboratory-supplied clean containers. Water samples to be analyzed for metals will be taken using "clean hands" methods consistent with the EPA's Method 1669 sampling protocol *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria* (EPA 1995). Samples requiring filtration before metals analysis will be filtered in accordance with standard protocols in the field. Certification of filter cleanliness will be obtained from the vendor and kept in the Project files.

All sample containers will be labeled with the date and time that the sample is collected, sampling site or identification label and handled in a manner consistent with appropriate chain-of-custody protocols. The sample container will be preserved (as appropriate), stored and delivered to a State of California-certified water quality laboratory for analyses of the parameters listed in Table 5.3.1-1 in accordance with maximum holding periods for each parameter. A chain-of-custody record will be maintained with the samples at all times. The sampling site location will be recorded using a GPS unit.

As part of the field quality assurance program, two field blanks and equipment rinsates will be collected and submitted to the laboratory (approximately one for every ten analyses). A field blank is a sample of analyte-free water poured into the container in the field, preserved and shipped to the laboratory with samples. A field blank for filtered samples will be similarly created, but filtered using field techniques before pouring into the container. A field blank assesses the contamination from field conditions during sampling. A rinsate is a sample of analyte-free water poured over or through decontaminated field sampling equipment prior to the collection of samples. It assesses the adequacy of the decontamination processes. Two duplicate samples will also be collected.

#### 5.3.3.1.3 Secchi Depth Readings in Reservoirs

Prior to collecting reservoir samples, a Secchi disk will be slowly lowered into the water on the shady side of the boat until it is no longer visible, and the depth recorded. Then, the Secchi disc will be slowly raised until it just becomes visible once again and this depth will be recorded a second time. The average the two depths will be considered the Secchi depth.

### 5.3.3.2 Recreation Water Quality Sampling

In accordance with bacteria sampling protocols, bacteria samples will be collected on five different days within a 30-day period which spans ~~either~~ the Independence Day holiday weekend and five different days within a 30-day period which spans the~~or~~ Labor Day holiday weekend~~s~~ (CVRWQCB 1998). A single petroleum hydrocarbon sample will be collected at each location during each of the holiday weekends included in the bacteria sampling. At each near-shore sample location, surface water will be collected from the near surface (bacteria) and/or the surface (petroleum hydrocarbons). Visual observations of oil and grease will be recorded in the field notebook.

### 5.3.4 Step 4 – Perform Laboratory Analyses

#### 5.3.4.1 Chemical Analyses

All laboratory analyses will be conducted using EPA Standard Methods or the equivalent sufficiently sensitive to detect and report at levels necessary for evaluation against state and federal water quality standards. A State of California-certified laboratory will prepare and analyze water samples for the following surface water analytical parameters:

- Basic Water Chemistry - Laboratory
- Inorganic Ions
- Metals
- Nutrients
- Petroleum Hydrocarbons

The analytes and target reporting limits associated with each parameter are listed in Table 5.3.1-1.

#### 5.3.4.2 Bacteria Analyses

Surface water samples collected adjacent to recreation sites will be analyzed for:

- Total coliform
- Fecal coliform
- Escherichia coli

Bacteria samples will be delivered to a local laboratory within the holding times required in Table 5.3.1-1.

### 5.3.5 Step 5 – Prepare Quality Assurance/Quality Control Review

All data will be verified and/or validated as appropriate. In brief, following the field sampling and laboratory analyses, which includes the laboratories' own QA/QC analysis, Licensee will subject all data to QA/QC procedures including, but not limited to: spot-checks of transcription; review of electronic data submissions for completeness; comparison of results to field blank and rinsate results; and, identification of any data that seem inconsistent. If such a datum is found, Licensee will consult with the laboratory to identify any potential sources of error before concluding that the datum is correct.

All verified chemical detections, including data whose results are "J" qualified,[2] will be used for this assessment. Should the laboratory need to re-extract samples and re-run the sample under different calibration conditions, the data identified by the laboratory, as the most certain, will be

[2] Results with a "J" qualifier are results where the chemical was detected, but there is uncertainty in the quantity. The quantity is above the method detection limit, but below the reporting limit.

used. If field-sampling conditions, as measured by the field blank and the rinsate sample results, indicate that samples have been corrupted, Licensee will identify the data accordingly.

### 5.3.6 Step 6 – Determine Consistentency with Basin Plan Objectives

Table 5.3.6-1 shows the standards, criteria and benchmark values that will be used to assist with in the assessment of sample results and their consistency with the Basin Plan Objectives. The selected values primarily consist of the Title 22 drinking water standards, which are incorporated by reference into the Basin Plan itself, and the California Toxics Rule (CTR) (EPA 2000). However, when a study analyte does not have a compliance threshold (benchmark) in one these preferred sources, benchmarks will be applied from *A Compilation of Water Quality Goals* (Marshack 2008, as amended for July 2008 – April 2010); *Water Quality Standards for Recreational Waters* (EPA 2003; another compilation with multiple regional sources); and others as cited.

**Table 5.3.6-1. Standards, Criteria and Benchmarks used for determining consistency with Basin Plan Objectives and designated beneficial uses of water in project reservoirs and project-affected stream reaches.[1]**

| Analyte | Symbol or Abbreviation | Standard, Criteria or Benchmark Value | Reference | Notes |
|---|---|---|---|---|
| **BACTERIA (MUN, REC-1)** | | | | |
| Total coliform | -- | < 10,000 MPN per 100 mL<br>< 240 MPN per 100 mL (geometric mean); | EPA 2003 | Water contact recreation, single-day sample;<br>Water contact recreation, 30-day geometric mean |
| Fecal coliform | -- | < 200 MPN per 100 mL (geometric mean); < 10% of samples > 400 MPN per 100 mL | CVRWQCB 1998 | Water contact recreation, 30-day geometric mean; with individual samples not > 400 MPN/100 mL |
| Escherichia coli | *E. coli* | < 126 MPN per 100 mL (geometric mean)<br>< 235 MPN per 100 mL in any single sample | CVRWQCB 2002; EPA 2003 | Water contact recreation, 30-day geometric mean |
| **BIOSTIMULATORY SUBSTANCES (COLD, SPAWN)** | | | | |
| Total Kjeldahl Nitrogen | TKN | None | -- | -- |
| Total Phosphorous | TP | None | -- | -- |
| **CHEMICAL CONSTITUENTS (MUN)** | | | | |
| Alkalinity | -- | 20 mg/L | Marshack 2008 | EPA AWQC; less than 20 mg/L can affect water treatment |
| Aluminum | Al | 1 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Arsenic | As | 0.01 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Cadmium | Cd | 5 µg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Calcium | Ca | None | -- | -- |
| Analyte | Symbol or Abbreviation | Standard, Criteria or Benchmark Value | Reference | Notes |
| Chromium (total) | Cr (total) | 50 µg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |

**Table 5.3.6-1. (continued)**

| | | | | |
|---|---|---|---|---|
| **CHEMICAL CONSTITUENTS (MUN) (continued)** | | | | |
| Copper | Cu | 1.3 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Lead | Pb | 15 µg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Mercury (inorganic[1]) | Hg | 2 µg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Nickel | Ni | 100 µg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Nitrate | $NO_3$-N | 45 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Nitrite | $NO_2$-N | 1 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Nitrate + Nitrite | $NO_3$-N+$NO_2$-N | 10 mg/L (combined total) | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Potassium | K | None | -- | -- |
| Selenium | Se | 50 µg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64431 Primary MCL |
| Sodium | Na | 20 mg/L | Marshack 2008 | Sodium Restricted Diet[2] |
| **DISSOLVED OXYGEN (COLD, SPAWN)** | | | | |
| Dissolved Oxygen | DO | > 7 mg/L (minimum) | CVRWQCB 1998 | Aquatic life protection |
| **FLOATING MATERIAL (REC-1, REC-2)** | | | | |
| Floating Material | -- | Narrative Criteria | CVRWQCB 1998 | Aesthetics – Absent by visual observation |
| **OIL & GREASE (REC-1, REC-2)** | | | | |
| Oil & Grease | -- | Narrative | CVRWQCB 1998 | Aesthetics – Absent by visual observation |
| Total Petroleum Hydrocarbons | TPH | None | -- | -- |
| **pH (MUN, COLD, SPAWN, WILD)** | | | | |
| pH | -- | 6.5-8.5 | CVRWQCB 1998 | Aquatic life protection |
| **SEDIMENT AND SETTLEABLE SOLIDS (REC-2, SPAWN, WILD)** | | | | |
| Sediment | -- | Narrative | CVRWQCB 1998 | See Geology and Soil Resources |
| **TASTES & ODOR (MUN)** | | | | |
| Aluminum | Al | 0.2 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64449 Secondary MCL |
| Chloride | Cl | 250 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64449 Secondary MCL |
| Copper | Cu | 1.0 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64449 Secondary MCL |
| Iron | Fe | 0.3 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64449 Secondary MCL |
| Silver | Ag | 0.1 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64449 Secondary MCL |
| Specific conductance | -- | 900 µS/cm | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64449 Secondary MCL |
| Sulfate | $SO_4^{2-}$ | 250 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64449 Secondary MCL |
| Total Dissolved Solids | TDS | 500 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64449 Secondary MCL |
| Zinc | Zn | 5 mg/L | CDPH 2010 cited in CVRWQCB 1998 | 22 CCR §64449 Secondary MCL |

**Table 5.3.6-1. (continued)**

| Analyte | Symbol or Abbreviation | Standard, Criteria or Benchmark Value | Reference | Notes |
|---|---|---|---|---|
| **TEMPERATURE (COLD, SPAWN)** | | | | |
| Temperature | -- | Narrative | CVRWQCB 1998 | See Water Temperature Study |
| **TOXICITY (COLD, SPAWN, MUN)** | | | | |
| Alkalinity | -- | 20 mg/L | Marshack 2008 | EPA AWQC; buffering capacity |
| Aluminum | Al | 0.087 µg/L | Marshack 2008 | EPA AWQC; aquatic life protective[3] |
| Ammonia as N (pH and Temp dependent) | $NH_3$-N | 24.1 mg/L (CMC); 4.1-5.9 mg/L (CCC) | EPA 2000 | CTR criteria over 0-20ºC assuming pH 7.0 |
| | | 5.6 mg/L (CMC); 1.7-2.4 mg/L (CCC) | EPA 2000 | CTR criteria over 0-20ºC assuming pH 8.0 |
| | | 0.9 mg/L (CMC); 0.3-0.5 mg/L (CCC) | EPA 2000 | CTR criteria over 0-20ºC assuming pH 9.0 |
| Arsenic | As | 0.34 mg/L (CMC); 0.15 mg/L (CCC) | EPA 2000 | CTR criteria |
| Cadmium (hardness dependent) | Cd | 0.16 µg/L (CMC); 0.25 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$ |
| | | 0.35 µg/L (CMC); 0.41 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$ |
| | | 0.54 µg/L (CMC); 0.56 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$ |
| | | 0.95 µg/L (CMC); 0.81 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$ |
| Chloride | Cl- | 860 mg/L (CMC); 230 mg/L (CCC) | Marshack 2008 | EPA AWQC; aquatic life protective |
| Chromium (hardness dependent) | Cr | 47.19 µg/L (CMC); 15.31 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$ |
| | | 83.25 µg/L (CMC); 27.0 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$ |
| | | 116.03 µg/L (CMC); 37.64 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$ |
| | | 176.31 µg/L (CMC); 57.19 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$ |
| Copper (hardness dependent) | Cu | 0.8 µg/L (CMC); 0.69 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$ |
| | | 1.54 µg/L (CMC); 1.25 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$ |
| | | 2.25 µg/L (CMC); 1.77 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$ |
| | | 3.64 µg/L (CMC); 2.74 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$ |
| Iron | Fe | 1 mg/L (CCC) | Marshack 2008 | EPA AWQC; aquatic life protective |
| Mercury (total) | Hg | 0.050 µg/L | EPA 2000 40 CFR 131.38 | CTR/Federal Register. 5/18/00 |

**Table 5.3.6-1. (continued)**

| Analyte | Symbol or Abbreviation | Standard, Criteria or Benchmark Value | Reference | Notes |
|---|---|---|---|---|
| **TOXICITY (COLD, SPAWN, MUN) (continued)** | | | | |
| Nickel (hardness dependent) ~~Nickel (continued) (hardness dependent)~~ | Ni ~~Ni (continued)~~ | 37.2 µg/L (CMC); 4.1 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$ |
| | | 66.9 µg/L (CMC); 7.4 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$ |
| | | 94.3 µg/L (CMC); 10.5 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$ |
| | | 145.2 µg/L (CMC); 16.1 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$ |
| Selenium (total) | Se | 20 µg/L (CMC) 5 µg/L (CCC) | Marshack 2008 | EPA AWQC; aquatic life protective |
| Silver (hardness dependent) | Ag | 0.02 µg/L (CMC) Instantaneous | EPA 2000 | CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$ |
| | | 0.07 µg/L (CMC) instantaneous | EPA 2000 | CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$ |
| | | 0.13 µg/L (CMC) instantaneous | EPA 2000 | CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$ |
| | | 0.32 µg/L (CMC) instantaneous | EPA 2000 | CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$ |
| Lead (hardness dependent) | Pb | 2 µg/L (CMC) 0.086 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$ |
| | | 5 µg/L (CMC) 0.191 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$ |
| | | 8 µg/L (CMC) 0.303 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$ |
| | | 14 µg/L (CMC) 0.54 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$ |
| Specific conductance | -- | 150 µmhos | CVRWQCB 1998 | Aquatic Life Protection |
| Zinc (hardness dependent) | Zn | 9.26 µg/L (CMC) 9.33 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$ |
| | | 16.66 µg/L (CMC) 16.79 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$ |
| | | 23.48 µg/L (CMC) 23.68 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$ |
| | | 36.20 µg/L (CMC) 36.50 µg/L (CCC) | EPA 2000 | CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$ |

**Table 5.3.6-1. (continued)**

| Analyte | Symbol or Abbreviation | Standard, Criteria or Benchmark Value | Reference | Notes |
|---|---|---|---|---|
| **TURBIDITY (COLD, SPAWN, WILD, MUN)** | | | | |
| Turbidity | NTU | increase < 1 NTU for 1-5 NTU background; increase < 20% for 5-50 NTU background; increase < 10 NTU for 50-100 NTU background | CVRWQCB 1998 | Aesthetics, disinfection |

[1] Note: a constituent may be listed under more than one beneficial use. When a standard or criterion was not available, benchmarks were excerpted from EPA (2003) and Marshack (2008).
[2] Guidance level to protect those individuals restricted to a total sodium intake of 500 mg/day (Marshack 2008).
[3] Benchmark is likely overly protective, as EPA is aware of field data indicating that many high quality waters in the U.S. contain more than 0.087 µg aluminum/L, when either total recoverable or dissolved is measured (Marshack 2008)

Key:
AWQC = Ambient Water Quality Criteria
EPA = Environmental Protection Agency
$CaCO_3$ = Calcium carbonate
CMC = Criterion Maximum Concentration (1-hour acute exposure) for aquatic toxicity as defined by EPA (2000)
CCC = Criterion Continuous Concentration (4-day chronic exposure) for aquatic toxicity as defined by EPA (2000)
CTR = California Toxics Rule
MCL = Maximum Contaminant Level
µmhos = micromhos
µg/L = micrograms per liter
mg/L = milligrams per liter
MPN = Most Probable Number
NTU = Nephelometric turbidity units
SM = Standard Method
su = standard unit

The CVRWQCB has adopted, by reference, California Title 22 maximum contaminant levels (MCL) for drinking water as Basin Plan objectives (CVRWQCB 1998), with the exception that more stringent criteria may apply as necessary for protection of specific beneficial uses. Hence, these values are adopted as the drinking water standard herein. It should be noted, however, that chemical concentrations that were originally intended to apply to finished tap water, rather than to untreated sources of drinking water, will be applied to the untreated reservoir or river water.

For water quality objectives related to aquatic toxicity for ammonia and trace metals, the CTR (EPA 2000) is the preferred benchmark source. Part 40 CFR § 131.38 established Criterion Maximum Concentrations (CMC) as the highest concentrations to which aquatic life can be exposed for a short period[3] [one hour] without deleterious effects and Criterion Continuous Concentrations (CCC) as the highest concentration to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects. When single grab samples are collected, as will be the case for this study, it is assumed that constituent concentrations are representative of the continuous ambient condition, and CCC values are therefore used as the appropriate criteria to compare against environmental sample results.

Because of differences in acute and chronic toxicity to aquatic organisms of many elements and compounds, as well as variations with ambient water quality such as pH or hardness, several entries in Table 5.3.6-1have multiple benchmarks to illustrate this range. The benchmarks for seven of the metals addressed in this study plan (cadmium, chromium, copper, lead, nickel, silver, and zinc) are reported for dissolved metals from the CTR (EPA 2000). In Table 5.3.6-1, benchmarks for these metals are calculated in 5 mg/L increments of hardness since the aquatic toxicity of these metals reportedly increases as hardness decreases. Similarly, the CMC and

[3] Based on extended sample collection and one-hour averaging.

CCC levels for ammonia are a function of both pH and temperature and are presented for the temperature range of 0º-20ºC in pH increments of 1.0 su in Table 5.3.6-1.

### 5.3.7 Step 7 – Consult with Operations Staff

If a water quality result suggests Basin Plan objectives are not being met, Licensee will consult with Project Operations staff to identify Project O&M activities that typically occur in the area with the potential to adversely-affect the parameter.

### 5.3.8 Collaboratively Agree on New Focused Second Year Study

Licensee will meet with interested and available Relicensing Participants no later than 6 weeks prior to the date that Licensee's Initial Study Report is scheduled to be filed with FERC, to review data available from the study at that time and discuss the need for, and scope of, a focused water quality study in 2013. The criteria to be used by Licensee and Relicensing Participants to consider the need for a focused second year study will be when a constituent is found at an elevated level, where elevated is defined as a level outside the standards, criteria and benchmarks provided in Table 5.3.6-1, and the elevated level can reasonably be attributed to Project effects. If Licensee and Relicensing Participants collaboratively agree focused studies are needed in a second year, Licensee will develop a new study proposal or modification to this study proposal (depending on the scope of work for the focused study), provide it to the SWRCB, CDFG, and Forest Service for review, ~~and Licensee will~~ file it with FERC prior to or at the same time as Licensee files its Initial Study Report, and implement the study as directed by FERC. If Licensee and ~~Relicensing~~ Relicensing Participants cannot reach consensus on the second year of focused water quality study ~~proposal~~, the SWRCB will determine the scope of the focused second-year sampling for ~~, and~~ Licensee to file ~~a new study proposal~~ with FERC prior to or at the same time as Licensee files its Initial Study Report.

### 5.3.9 Step 9 – Prepare Report

At the conclusion of the study, YCWA 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 include in Microsoft Excel format on compact disc (CD) a complete water quality dataset. Also, the report will include a table that will show for each parameter measured the results of the sampling sorted by sampling location. Data that that are greater than the benchmarks provided in Table 5.3.6-1 will be highlighted. The table will be appended to report and available in its Microsoft Excel format.

## 6.0 Study-Specific Consultation

This study requires three~~one~~ study-specific consultations:

- If Licensee and Relicensing Participants collaboratively identify additional locations of concern regarding Project-related bacteria during the Recreation Use and Visitor Surveys

Study (Study 8.1), additional recreation-related bacteria sampling will be performed at the locations, as discussed in Step 2.

- Licensee will make a good faith effort to keep Relicensing Participants informed of the study's progress and preliminary findings from verified and/or validated data following data QA/QC, as discussed in Step 3.
- Licensee will collaborate with Relicensing Participants regarding need for a focused second year study, as discussed in Step 8.

## 7.0 Schedule

Licensee anticipates the schedule to complete the study as follows assuming ~~the Preliminary Application Document (PAD) is filed on November 5~~1, 2010 and FERC issues its Study Determination by September 16, 2011 and the study is not disputed by a mandatory conditioning agency~~September 16October 4, 2011~~:

Select Parameters and Sampling Locations (Steps 1 & 2).....September~~October~~ 2011
Collect Data (Step 3).....September 2011-June 2012
Lab Analysis and QA/QC Review (Steps 4 & 5) .....October 2011—July 2012
Basin Plan Consistency and Operations Staff Consultation (Steps 6 & 7)~~December~~ September 2012~~1~~
Collaborative Review of Data and Need for Focused Study (Step 8).....[See Section 5.3.8]
Prepare Report (Step 9)..... ~~January - March~~ July-September 2012

## 8.0 Consistency of Methodology with Generally Accepted Scientific Practices

The study methods discussed above are consistent with the study methods followed in several other relicensings. The methods presented in this study plan also are consistent with those used in recent relicensings in California.

## 9.0 Level of Effort and Cost

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

## 10.0 References Cited

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Study 2.4

# BIOACCUMULATION

February 11, 2011

## 1.0 Project Nexus

Impoundment of water and operation of the Yuba County Water Agency's (YCWA or Licensee) Yuba River Development Project (Project) facilities have potential to increase the methylated mercury in the system, making it available for bioaccumulation through various trophic levels of the aquatic ecosystem.

## 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 Study Goals and Objectives

The goal of the study is to characterize the concentration of methylmercury in edible-size fish in the Project's New Bullard's Bar Reservoir.

As it is practical to also analyze the collected samples for other metals, fish tissue will also be analyzed for arsenic, copper, selenium, and silver.

## 4.0 Existing Information and Need for Additional Information

Available information consists of existing regulatory plans and advisories for the watershed, as well as water quality data collected to date in the Project Area.[1]

[1] The Project Area is defined as the area within the FERC Project Boundary and the land immediately surrounding the FERC Project Boundary (i.e., within about 0.25 mile of the FERC Project Boundary) and includes Project-affected reaches between facilities and downstream to the next major water controlling feature or structure.

## 4.1 Regulatory Status for Surface Water and Fish in the Project Area

Beneficial uses and water quality objectives for the Project Area are documented within the Central Valley Regional Water Quality Control Board's (CVRWQCB) *Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin Rivers*, the fourth edition, which was initially adopted in 1998 and most recently revised in 2007 (CVRWQCB 1998). The Basin Plan's designations for Yuba River Development Project and the area downstream of the Project include freshwater aquatic habitat (COLD) and water contact recreation (REC-1), which incorporate the uses commercial or recreational collection of fish, shellfish, or organisms. Since the main concern with mercury is that it bioaccumulates in aquatic systems to levels that are harmful to fish and their predators, including humans, the presence of mercury in its bioavailable form (methylmercury) has the potential to impair Project waters due to toxicity.

The toxicity water quality objective states that *"…all waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.*"

Section 303(d) of the Clean Water Act (CWA) requires that every two years each State submit to the United States Environmental Protection Agency (EPA) a list of impaired rivers, lakes and reservoirs for which pollution control or requirements have failed to provide for water quality. Based on a review of this list and its associated Total Maximum Daily Load (TMDL) Priority Schedule, in the Project Vicinity,[2] United States Army Corps of Engineer's (USACE) Englebright Reservoir has been identified by the State Water Resources Control Board (SWRCB) as CWA §303(d) State Impaired for potential toxicity due to mercury (SWRCB 2006). There are currently no approved TMDL plans for the Yuba River. Kanaka Creek, which is a tributary to the Middle Yuba River 4 miles upstream of Our House Diversion Dam, is listed under Section 303(d) of the Clean Water Act as "impaired" due to arsenic levels and contributes to the measured high levels of arsenic.

In 2009, the CVRWQCB recommended including additional surface waters in the Project Vicinity to the 303(d) list as impaired for mercury: New Bullards Bar Reservoir, the Middle Yuba River, the North Fork Yuba River from New Bullards Bar Dam to Englebright Reservoir, the South Yuba River from Lake Spaulding to USACE's Englebright Reservoir, and the Lower Yuba River from USACE's Englebright Reservoir to the Feather River (CVRWQCB 2009). These recommendations were based on fish tissue mercury data provided in SWRCB (2002) and Melwani et. al. (2007) [See Section 4.2.] and the potential impairment of beneficial uses due to toxicity. These recommendations must be approved by the SWRCB and the United States EPA before the list is modified.

Along a parallel regulatory path, using available fish tissue data and risk-based methodologies, the Office of Environmental Health Hazard Assessment (OEHHA) has issued species-specific fish ingestion advisories for trout, sunfish and bass caught in USACE's Englebright Reservoir (OEHHA 2003, OEHHA 2009). In the Project Vicinity, fish ingestion advisories previously

[2] The Project Vicinity is defined as the area surrounding the Project in the order of a United States Geological Survey 1:24,000 topographic quadrangle.

issued for Deer Creek, a tributary to the Yuba River, and the Lower Yuba River from USACE's Englebright Reservoir to the Feather River were recently retracted (OHHEA 2009).

## 4.2 Existing Methylmercury Bioaccumulation Information

Existing, relevant and reasonably available information found at the Project Area was documented in Section 7.2.9 of the Licensee's Pre-Application Document and is summarized below

Since the early 1990's, the upper Yuba River watershed has been studied by University of California, Davis, and the United States Geological Survey (USGS) (Alpers et al. 2005; Hunderlach et al. 1999; May et al. 2000; Slotton et al. 1995 IN May et al. 2000; and Slotton et al, *in preparation IN* OEHHA 2009). Findings from these studies indicate that significant amounts of Gold Rush era mercury still exist in sediments, surface water and fish of the upper Yuba watershed. Sediments are being transported downstream into reservoirs on the Yuba River, where they are largely trapped (Hunderlach et al. 1999; Alpers et al. 2005). Findings from these studies also indicate that fish tissue concentrations of mercury exceed the criteria established for protection of human health at some locations (Table 4.2-1).

**Table 4.2-1. Mercury measured in fish tissue in the Project Vicinity.**

| Location | Species Sampled | Number of Fish | Mercury, Total (ppm)[1] | Total Length (mm) | Data Source |
|---|---|---|---|---|---|
| **UPSTREAM OF THE PROJECT AREA** | | | | | |
| North Yuba River near Canyon Creek | Rainbow trout | 5 | 0.19 – 0.14 (avg 0.11) | 236 - 311 | Slotton et al. (1997) |
| Middle Yuba River one mile upstream of Plumbago Road | Rainbow trout | 5 | 0.05 - 0.19 (avg 0.11) | 292 - 415 | Slotton et al. (1997) *IN* CVRWQCB (2009) |
| Middle Yuba River upstream of Kanaka Creek [one mile upstream of Tyler Foote crossing] | Rainbow trout | 9 | 0.10 - 0.24 (avg 0.16) | 210 - 387 | |
| Middle Yuba River just upstream of Oregon Creek and Highway 49 | Rainbow Trout | 3 | 0.15-0.21 (avg 0.18) | 204 - 278 | |
| | Sacramento Pikeminnow | 2 | 0.56 and 0.81 | 321 - 339 | |
| Middle Yuba River one mile downstream of the Highway 49 crossing | Sacramento Pikeminnow | 4 (composite) | 0.64 | ≥ 150 | SWRCB (2002) *IN* CVRWQCB (2009) |
| South Yuba River below Lake Spaulding | Brown trout | 2 | 0.07 and 0.07 | 224 -249 | Slotton et al. (1997) *IN* CVRWQCB (2009) |
| | Rainbow trout | 3 | 0.06-0.11 (avg 0.080 | 180 - 228 | |
| South Yuba River at Washington | Rainbow trout | 13 | 0.10 - 0.30 (avg 0.15) | 183 - 345 | Slotton et al. (1997) *IN* CVRWQCB (2009) |
| South Yuba River just downstream of Edwards Crossing | Rainbow trout | 2 | 0.09 and 0.15 | 182 - 270 | May et al. (2000) *IN* CVRWQCB (2009) |
| South Yuba River near Bridgeport | Smallmouth Bass | 3 (composite) | 0.69 | ≥ 150 | SWRCB (2002) *IN* CVRWQCB (2009) |
| **WITHIN THE PROJECT AREA** | | | | | |
| New Bullards Bar Reservoir--East Arm near its confluence with the West Arm | Smallmouth Bass | 13 | 0.22 - 0.68 avg 0.39 | ≥ 150 | SWRCB (2002) *IN* CVRWQCB (2009) |

**Table 4.2-1. (continued)**

| Location | Species Sampled | Number of Fish | Mercury, Total (ppm)[1] | Total Length (mm) | Data Source |
|---|---|---|---|---|---|
| **WITHIN THE PROJECT AREA (continued)** | | | | | |
| New Bullards Bar Reservoir--East Arm near the Willow Creek inlet | Bluegill | 3 | 0.12-0.39 (avg 0.21) | ≥ 150 | Melwani et al. (2007) *IN* CVRWQCB (2009) |
| | Carp | 11 | 0.34-0.83 (avg 0.52) | ≥ 150 | |
| | Largemouth Bass | 1 | 0.61 | ≥ 150 | |
| | Smallmouth Bass | 10 | 0.29-0.72 (avg 0.48) | ≥ 150 | |
| | Carp | 6 (composite) | 0.61 | ≥ 150 | SWRCB (2002) *IN* CVRWQCB (2009) |
| | Smallmouth Bass | 5 (composite) | 0.63 | ≥ 150 | |
| New Colgate Powerhouse Reach, approximately 1.3 miles upstream of USACE's Englebright Reservoir | Smallmouth Bass | 5 | 0.27 - 0.56 avg of 0.38 | ≥ 150 | SWRCB (2002) IN CVRWQCB (2009) |
| USACE's Englebright Reservoir—South Yuba Arm, Hogsback Ravine Arm, and mid-section. | largemouth smallmouth and spotted bass | 56 | 0.45 (mean) | 338 (mean) | May et al. (2000) and Slotton et al. (1997) IN CVRWQCB (2001); Slotton et. al. in press *IN* OEHHA (2009) |
| | Bluegill and green sunfish | 31 | 0.30 (mean) | 161 (mean) | |
| | Rainbow trout | 49 | 0.08 (mean) | 290 (mean) | |
| | Carp | 1 | 0.88 | 440 | Slotton et al. (1997) |
| | Hardhead | 1 | 0.47 | 540 | |
| | Sacramento sucker | 5 | 0.41-0.89 | 410-523 | |
| Narrows 2 Powerhouse Reach, Lower Yuba River, approximately 2.2 miles downstream of Englebright Dam | Rainbow Trout | 9 | 0.07 - 0.13 avg 0.10 | ≥ 150 | Slotton et al. (1997) in CVRWQCB (2009) |
| Little Deer Creek at Pioneer Park, less than one mile from the confluence with Deer Creek (tributary to Yuba River) | Brown trout | 6 | 0.23 - 0.39 avg 0.32 | ≥ 150 | May et al. (2000); SWRCB (2002) *IN* CVRWQCB (2009) |
| **DOWNSTREAM OF THE PROJECT AREA** | | | | | |
| Daguerre Point Dam Reach, Lower Yuba River, approximately 0.9 miles upstream of its confluence with the Feather River | Rainbow Trout | 1 | 0.02 | ≥ 150 | SWRCB (2002) *IN* CVRWQCB (2009) |
| | Sacramento Pikeminnow | 1 | 0.46 | | |
| | Sacramento Sucker | 2 | 0.22 and 0.38 | | |
| | Smallmouth Bass | 4 | 0.26-0.72 (avg 0.43) | | |
| Lower Yuba River, approximately 3.6 miles upstream of its confluence with the Feather River | Sacramento Pikeminnow | 2 | 0.31 and 1.43 | ≥ 150 | Davis et al. (2002) *IN* CVRWQCB (2009) |
| | Sacramento Sucker | 5 (composite) | 0.39 | | |
| | Rainbow Trout | 3 | 0.08-0.1 (avg 0.09) | 310 (avg) | Grenier et al. (2007) *IN* CVRWQCB (2009) |
| | Sacramento Pikeminnow | 5 | 0.19-1.58 (avg 0.84) | ≥ 150 | |
| | Sacramento Sucker | 3 | 0.11-0.73 (avg 0.26) | 420 (avg) | |

[1] All concentrations are in wet-weight.

In the Project Area, Slotton et al. (1997) also observed notably lower invertebrate mercury concentrations below many of the foothill reservoirs, as compared to concentrations in similar biota upstream. Specifically, the invertebrates below New Bullard's Bar Dam were considerably lower in mercury than those collected upstream of the reservoir on the North Yuba River. Similarly, the invertebrates collected below the USACE's Englebright Reservoir were consistently far lower in mercury than samples collected upstream of the reservoir on the Middle and South Yuba River. In contrast, however, reservoir dwelling fish had higher mercury tissue concentrations than fish collected from Coastal Range reservoirs, near historic mercury mines. This would suggest that mercury in the Sierra Nevada reservoirs is in a more bioavailable form than mercury in the Coastal Range reservoirs (Slotton et al. 1997).

Historic data demonstrates mercury concentration in fish; however, additional information regarding some sport fish species in the Project's New Bullards Bar Reservoir would be useful.

In 2009, 66 fish were collected and analyzed from five reservoirs upstream of or near the Project as part of the Federal Energy Regulatory Commission relicensing of Nevada Irrigation District's Yuba-Bear Hydroelectric Project (FERC Project No. 2310) and Pacific Gas & Electric's Drum-Spaulding Project (FERC Project No. 2266) (NID and PG&E 2010). In addition to mercury, which is discussed above, fish tissue were also analyzed for copper, selenium and silver in fish collected from Jackson Meadows Reservoir, Faucherie Lake, Bowman Lake, Fordyce Lake and Lake Spaulding. The fish species examined included rainbow trout, brown trout, kokanee, and Chinook salmon. Copper was found in both fish tissue and surface water collected from the same reservoirs. Selenium was found in fish tissue, but was not detected in surface water. Silver was not detected in any sample, nor was it found in surface water at the low reporting limits employed. Arsenic was found in trace quantities in surface water, but was not analyzed for in fish tissue. All of these metals can be found in chemical forms known to bioaccumulate, but at much lower rates of uptake than mercury.

It would be practical to also analyze the collected samples for other metals, such as copper, selenium, and silver, to be consistent with upstream studies, and arsenic a bioaccumulative constituent of concern in the watershed.

# 5.0 Study Methods and Analysis

The sampling and analysis plan (SAP) and quality assurance project plan (QAPP) of the SWRCB's Surface Water Ambient Monitoring Program's (SWAMP) on-going statewide survey of contaminants in lake and reservoir sport fish will be followed (Davis et al 2007; Bonnema 2007).

## 5.1 Study Area

The study will be conducted within the reservoir habitat of New Bullards Bar Reservoir

## 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 (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.

## 5.3 Methods

This study will include five steps: 1) sample collection, 2) laboratory analysis, 3) evaluation of measured methylmercury fish tissue concentrations for consistency with the screening-level human health protective thresholds, 4) quality assurance, and 5) report preparation. Each of the steps is described below.

### 5.3.1 Step 1 – Sample Collection

Field samples will be handled in a manner consistent with the SWRCB Surface Water Ambient Monitoring Program (SWAMP) Bioaccumulation Oversight Group (BOG) Quality Assurance Project Plan (QAPP) (Bonnema 2007). The SWAMP BOG QAPP incorporates the collection methods outlined in the California Environmental Protection Agency's (Cal EPA) *General Protocol for Sport Fish Sampling and Analysis* (Cal EPA 2005) and California Department of Fish and Game's (CDFG) Method #MPSL-102a (CDFG 2005) for handling of fish. Being consistent with the SWAMP BOG QAPP ensures that tissue results would be consistent with SWAMP's ongoing statewide fish tissue sampling campaign (Davis et al 2009; Davis et al. 2010).

The Marine Pollution Studies Laboratory (MPSL) of the CDFG at Moss Landing will collect the fish for this study. Fish will be collected by electroshocking, fishing line or gill nets over one or two visits. Resident salmonid species will be the target species for New Bullards Bar, as mercury concentrations in smallmouth bass (*Micropterus dolomieu*) and other species have been studied and evaluated by the CVRWQCB and OEHHA (Table 4.2-1). As a goal, nine fish each will be collected of Kokanee salmon (*Oncorhynchus nerka*) and rainbow trout (*O. mykiss*), fish species most routinely sought by fishermen in New Bullards Bar. (Brady, pers. comm.; Table 5.3.1-1.). Rainbow trout and brown trout (*Salmo trutta*) are the fish of interest in the diversion impoundments.

**Table 5.3.1-1. Target fish species, sizes and numbers by location.**

| Sampling Location[1] | Species[1] | Target Number of Fish for Collection[2] | Edible Size[3] (minimum total length) |
|---|---|---|---|
| **NORTH YUBA RIVER** | | | |
| New Bullards Bar Reservoir | Smallmouth bass | 9 | ≥305 millimeters |
| | Kokanee salmon | 9 | ≥200 millimeters |
| | Rainbow trout | 9 | ≥200 millimeters |
| **OREGON CREEK** | | | |
| Our House Diversion Dam Impoundment | Rainbow trout | 9 | ≥200 millimeters |
| | Brown trout | 9 | ≥200 millimeters |
| **MIDDLE YUBA RIVER** | | | |
| Log Cabin Diversion Dam Impoundment | Rainbow trout | 9 | ≥200 millimeters |
| | Brown trout | 9 | ≥200 millimeters |

[1] Fish will be collected over one or two visits.
[1] ~~Brady, *pers. comm.*~~
[2] OEHHA (2009)
[3] Appendix I of Cal EPA (2005)

For each fish collected, the following attributes will be recorded: species, total length or fork length in millimeters (mm), as appropriate, and weight in grams (g). Electroshock, gill net and line fishing sites will be recorded using a hand-held GPS unit.

### 5.3.2 Step 2 – Perform Analysis

Fish tissue samples will be delivered by the MPSL-CDFG to their laboratory in Moss Landing, California, a California-certified analytical laboratory. Analytical methods will be consistent with the SWRCB SWAMP BOG QAPP, which includes the criteria for data quality acceptability, testing (including deviations), calibration, and preventative and corrective measures (Bonnema 2007). Samples will be analyzed for total mercury, which is assumed to be comprised primarily of methylmercury.[3] Tissue will also be analyzed for arsenic, copper, selenium and silver. The methods and reporting limits for mercury and the four additional metals in fish tissue are~~is~~ provided in Table 5.3.2-1.

**Table 5.3.2-1. Analytical methods and reporting limits.**

| Metal | Analytical Method | Reporting Limit (µg/g wet-weight) |
|---|---|---|
| Mercury | EPA 7473[1] | 0.01 |
| Arsenic | ~~TBD~~ EPA 200.8 | ~~TBD~~0.30 |
| Copper | EPA 200.8 | 0.20 |
| Selenium | EPA 200.8 | 0.40 |
| Silver | EPA 200.8 | 0.01 |

[1] EPA 7473 analyzes for mercury in solids and solutions by thermal decomposition, amalgamation and atomic absorption spectrometry (EPA 1998)
µg/g = micrograms per gram or parts-per-million

Results will be reported in wet-weight; however percent moisture will be measured and reported.

### 5.3.3 Step 3 – Consistency with Human Health Protective Thresholds

Methylmercury water quality objectives are expressed as fish tissue concentrations.[4] Consequently, results of mercury analyses will be compared to California's threshold level for determining the potential impairment of a body of water based on pollutants in fish tissue (Davis et al. 2009). Measured mercury tissue concentrations will be compared to the OEHHA's current Advisory Tissue Level (ATL) of 0.070 ppm mercury wet-weight (Klasing and Brodberg 2008). The threshold from Klasing and Brodberg (2008) corresponds to a concentration at which OEHHA would begin to consider advising limiting consumption by children and women of child-bearing age to fewer than eight meals per month. Similarly, OEHHA may recommend no consumption by children and women of child-bearing age when fish tissue methylmercury concentrations are greater than or equal to 0.44 ppm wet-weight. By way of comparison, the ATL for an adult male ingesting one serving of fish per week is 0.44 ppm to 1.3 ppm wet-weight.

[3] Of the total amount of mercury found in fish muscle tissue, methyl mercury comprises more than 95 percent (ATSDR 1999; Bloom 1992).
[4] For example, the Federal ambient water quality criterion for mercury is 0.3 mg/kg (or ppm) methylmercury/fish tissue wet-weight, regardless of a person's age or meal frequency (USEPA 2001).

As agreed with the SWRCB, Licensee will report the concentrations of arsenic, copper, selenium and silver in fish tissue, but for these metals will not discuss consistency with human health or other criteria/objectives/thresholds.

### 5.3.4 Step 4 – Quality Assurance

Field and laboratory quality assurance will be ensured by following standard protocols, consistent with the SWRCB SWAMP BOG QAPP (Bonnema 2007).

MPSL is a California-certified laboratory. Analytical methods will be consistent with the SWRCB SWAMP BOG QAPP (Bonnema 2007), which includes the criteria for data quality acceptability, testing (including deviations), calibration, and preventative and corrective measures. Laboratory quality assurance documentation will be attached to the report.

### 5.3.5 Step 5 – Prepare Report

YCWA 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. Fish tissue concentrations greater than the mercury ATL will be highlighted. MPSL-DFG's field data, laboratory report, and quality assurance information will be attached. Mercury arsenic, copper, selenium and silver data will be available in Microsoft Excel format.

## 6.0 Study-Specific Consultation

This study does not require any study-specific consultation.

## 7.0 Schedule

Licensee anticipates the schedule to complete the study proposal as follows assuming FERC's Study Plan Determination is deemed final on September 16, 2011 and the study is not disputed by a mandatory conditioning agency~~October 20, 2011~~:

Collect Data (Step 1)..... October-November 2011
Lab Analysis (Step 2).....December 2011 – February 2012
Consistency with Thresholds (Steps 3).....March – April 2012
Quality Assurance (Step 4) .....May - June 2012~~1~~
Report Writing ..... September - October 2012

# 8.0 Consistency of Methodology with Generally Accepted Scientific Practices

The ~~s~~study methods discussed above are consistent with the study methods followed in several other relicensings. The methods presented in this study plan also are consistent with those used in recent relicensings in California.

# 9.0 Level of Effort and Cost

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

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Study 2.5

# WATER TEMPERATURE MONITORING

February 11, 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 water temperature.

## 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 Licensee 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

Licensee is actively collecting stream water temperature data upstream, within and downstream of the Project, and is also collecting reservoir water temperature data in New Bullards Bar Reservoir and in the United States Army Corps of Engineer's (USACE) Englebright Reservoir. Table 5.3.1-1 lists Licensee's stream temperature data collection network and the period of record for each site as of July 2009. Data have been collected at several locations in the Yuba River below USACE's Englebright Dam since 2003; at other locations, data collection began in summer 2008. Reservoir temperature data have been recorded twice per month by Licensee since 1990 at a single point near the upstream face of New Bullards Bar Dam and at a single point near the upstream face of USACE's Englebright Dam. Normally, reservoir data have been collected at 10-foot intervals, along with *in situ* air temperature. Data collected during these efforts is available in the Preliminary Information Package (YCWA 2009) in section 7.2.9, Existing Water Quality Information.

# 4.0 Study Goals and Objectives

The goals of this Water Temperature Monitoring Study are: 1) to characterize water temperature conditions in reservoirs and river reaches potentially affected by continued Project O&M; and 2) to facilitate development of a water temperature model or models, as may be necessary, to provide useful tools in the Project relicensing.

The objective of the study is to collect water temperature and metrological data adequate to meet the study goals.

# 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 North Yuba River, 3) the North Yuba River from and including New Bullards Bar Dam Reservoir to the confluence with the Middle Yuba River, and 4) and the portion of the Yuba River from the confluence of the North and Middle Yuba rivers to the Feather River, including 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 (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.

## 5.3 Study Methods

The study will be completed in the four steps: 1) identify monitoring sites; 2) install and maintain recorders and download data; 3) perform quality assurance/quality control (QA/QC) of data; and 4) prepare report. Step 1 and Step 2 each has three components: 1) stream water temperature monitoring; 2) reservoir water temperature monitoring; and 3) meteorological monitoring. Each step is described below.

### 5.3.1 Step 1 - Identify Monitoring Sites

The locations at stream and reservoir water temperatures and metrological data will be collected are described below.

#### 5.3.1.1 Stream Water Temperature

Table 5.3.1-1 below provides a list of 38 locations at which YCWA will maintain continuous water temperature recorders in streams. Many of these are locations where data have been collected, to the extent possible, continuous water temperature recorders will be co-located with existing United States Geological Survey (USGS) or YCWA stream flow gages.

**Table 5.3.1-1. Locations at which continuous water temperature data will be collected, including current data availability.**

| Project Reach | Location | Designation for Recorders[1] | River Mile | Latitude | Longitude | ~~Period of Record~~Data Available (as of 1/10/11) | Streamflow Gage, if Co-Located[3] |
|---|---|---|---|---|---|---|---|
| **MIDDLE YUBA RIVER** | | | | | | | |
| ----- | Upstream of Our House Diversion Dam Impoundment | T10a T10b | MYR 12.2 | 39.413015 | -120.994590 | 3/28/09-~~9/6~~11/9/10 | -- |
| Our House Diversion Dam Reach | At Intake to Lohman Ridge Diversion Tunnel | T20 | MYR 12.0 | 39.411910 | -120.997427 | 7/3/08-~~6/6~~11/3/10 | USGS 11408870 (PG&E NY17) |
| | Downstream of Our House Diversion Dam | T30 | MYR 11.9 | 39.410661 | -120.998604 | 10/24/08-~~6/6/10~~11/3/10 | USGS 11408880 (PG&E NY18) |
| Oregon Creek Reach | Upstream of North Yuba River | T90a T90b | MYR 0.0 | 39.368639 | -121.135658 | 8/19/08-12/18/08, 3/28/09-~~9/6/10~~11/9/10 | -- |
| **OREGON CREEK** | | | | | | | |
| ----- | Upstream of Log Cabin Diversion Dam Impoundment | T40 | OC 4.3 | 39.440146 | -121.056149 | 7/8/08-~~6/6/10~~11/2/10 | USGS 11409300 (PG&E NY19) |
| Log Cabin Diversion Dam Reach | At Intake to Camptonville Diversion Tunnel | T50 | OC 4.1 | 39.440491 | -121.058746 | 7/8/08-~~6/6/10~~11/3/10 | USGS 11409350 (PG&E NY30) |
| | Downstream of Log Cabin Diversion Dam | T60 | OC 4.0 | 39.439455 | -121.059264 | 8/30/08-~~6/6/10~~11/3/10 | USGS 11409400 (PG&E NY20) |
| | Upstream of confluence with Middle Yuba River | TBC | ~~TBC~~ OC 0.1 | TBD~~C~~ | TBDC | To Be Installed Upon Study Proposal Approval~~TBC~~ | -- |
| **NORTH YUBA RIVER** | | | | | | | |
| ----- | Upstream of New Bullards Bar Reservoir | T65a T65b | NYR 16.0 | 39.523728 | -121.090972 | 1/1/08-~~5/18/10~~8/11/10 | -- |
| New Bullards Bar Dam Reach | At Low Flow Releases from New Bullards Bar Dam | T70a T70b | NYR 2.3 | 39.392348 | -121.141584 | 7/18/08-~~6/6/10~~11/3/10 | USGS 11413517 (PG&E NY23) |
| | Upstream of Middle Yuba River | T80a T80b | NYR 0.0 | 39.368694 | -121.136793 | 8/19/08-12/18/08, 3/28/09-~~9/6/10~~11/9/10 | -- |
| **SOUTH YUBA RIVER** | | | | | | | |
| ----- | At Jones Bar (data collected on 1-hr interval, rather than every 15 min) | Jones Bar a Jones Bar b Jones Bar c | SYR 6.2 | 39.292222 | -121.103610 | 5/16/08 – 6/6/10 | USGS 11417500 (PG&E NY29) |
| **DOBBINS CREEK** | | | | | | | |
| ----- | At Lake Francis Outlet[2] | T140a T140b | DC 2.4 | 39.359171 | -121.205168 | 4/2/09-~~9/6/10~~11/9/10 | -- |
| ----- | Upstream of Yuba River | T145a T145b | DC 0.1 | 39.329735 | -121.197641 | 4/2/09-~~9/6/10~~11/9/10 | -- |
| **DRY CREEK** | | | | | | | |
| ----- | Upstream of Yuba River | T185a T185b | DryC 0.7 | 39.228930 | -121.402270 | 4/1/09-~~9/11/10~~12/8/10 | -- |
| **DEER CREEK** | | | | | | | |
| ----- | Upstream of Yuba River | T175a T175b | DeerC 0.9 | 39.224091 | -121.269866 | 2/3/09-~~8/4/10~~11/3/10 | -- |

**Table 5.3.1-1. (continued)**

| Project Reach | Location | Designation for Recorders[1] | River Mile | Latitude | Longitude | Period of Record | Streamflow Gage, if Co-Located[3] |
|---|---|---|---|---|---|---|---|
| **YUBA RIVER** | | | | | | | |
| Middle/ North Yuba River Reach | Downstream of Confluence of North Yuba River and Middle Yuba River | T100a T100b | YR 39.7 | 39.367839 | -121.136655 | 8/19/08-12/18/08, 3/28/09-~~9/6/10~~11/9/10 | ----- |
| | Upstream of New Colgate Powerhouse | T110a T110b | YR 34.1 | 39.330602 | -121.187675 | 8/19/08-12/18/08, 3/28/09-~~9/6/10~~11/9/10 | ----- |
| New Colgate Powerhouse Reach | In Colgate Powerhouse Penstock | T120 | YR 33.9 | 39.330824 | -121.191565 | 1/1/08-~~8/8/10~~12/31/10 | -- |
| | Downstream of New Colgate Powerhouse | T130a T130b | YR 33.8 | 39.330260 | -121.193169 | 8/19/08-12/18/08, 3/28/09-~~9/6/10~~11/9/10 | -- |
| | Downstream of Dobbins Creek | T150a T150b | YR 33.6 | 39.328398 | -121.196162 | 3/28/09-~~9/6/10~~11/9/10 | -- |
| | In Narrows #2 Powerhouse Penstock | T160a T160b | YR 23.9 | 39.238911 | -121.270034 | 5/5/09-~~8/2/10~~12/31/10 | (PG&E NY24) |
| | Downstream of Narrows #2 Powerhouse at Smartville | T170 | YR 23.6 | 39.235799 | -121.272688 | 4/15/09-~~8/2/10~~12/8/10 | USGS 11419000 (PG&E NY28) |
| | Downstream of Narrows #2 Powerhouse at Smartville (data collected on 1-hr interval, rather than every 15 min) | Smartville a Smartville b Smartville c | YR 23.6 | 39.235799 | -121.272688 | WY2003 - 2007 | USGS 11419000 (PG&E NY28) |
| | Downstream of Deer Creek | T180a T180b | YR 22.7 | 39.230047 | -121.285165 | 11/8/08-~~8/2/10~~11/7/10 | -- |
| | Downstream of Dry Creek | T190a T190b | YR 13.3 | 39.219611 | -121.415128 | 11/8/08-3/9/09 | -- |
| | At Parks Bar (data collected on 1-hr interval, rather than every 15 min) | Parks Bar a Parks Bar b Parks Bar c | YR 17.4 | 39.219612 | -121.346980 | ~~TBC~~6/14/04 – 10/25/10 | ----- |
| | At Long Bar (data collected on 1-hr interval, rather than every 15 min) | Longs Bar a Longs Bar b Longs Bar c | YR 16.0 | 39.218503 | -121.369961 | ~~TBC~~4/8/04 – 12/9/10 | ----- |
| | Upstream of USACE's Daguerre Point Dam | T200a Y200b | YR 11.5 | 39.208009 | -121.443116 | 11/8/08-~~9/9/10~~11/15/10 | -- |
| USACE's Daguerre Point Dam Reach | At USACE's Daguerre Point Dam Fish Ladder | T210a T210b | YR 11.4 | 39.207853 | -121.443529 | 11/18/08-~~9/7/10~~11/14/10 | -- |
| | At USACE's Daguerre Point Dam Fish Ladder (data collected on 1-hr interval, rather than every 15 min) | Daguerre a Daguerre b Daguerre c | YR 11.4 | 39.208009 | -121.443116 | WY2003 – 2007 | -- |
| | At Walnut Avenue (Near Western Extent of Yuba Goldfields) | T220a T220b | YR 8.1 | 39.188220 | -121.495307 | 8/28/08-~~9/13/10~~11/8/10 | -- |
| | At Marysville Gage (data collected on 1-hr interval, rather than every 15 min) | Marysville a Marysville b Marysville c | YR 6.0 | 39.176164 | -121.524386 | WY2003 ~~–~~ 2007, 1/1/08 – 11/25/10 | USGS 11421000 |
| | Upstream of Simpson Lane (Between Yuba Goldfields and Marysville) | T230a T230b | YR 4.8 | 39.165328 | -121.541350 | 8/28/08-~~9/13/10~~11/8/10 | -- |
| | At Marysville (Downstream of Highway 70 Bridge | T240a T240b | YR 0.7 | 39.134510 | -121.590720 | 8/21/08-~~9/26/10~~12/9/10 | -- |

**Table 5.3.1-1. (continued)**

| Project Reach | Location | Designation for Recorders[1] | River Mile | Latitude | Longitude | Period of Record | Streamflow Gage, if Co-Located[3] |
|---|---|---|---|---|---|---|---|
| **FEATHER RIVER** | | | | | | | |
| ----- | Upstream of Yuba River | T250a<br>T250b | ----- | 39.139425 | -121.607282 | 8/15/08-~~9/26/10~~12/9/10 | -- |
| ----- | Downstream of Yuba River on Right Bank | T260a<br>T260b | ----- | 39.108603 | -121.603149 | 8/15/08-~~9/26/10~~12/9/10 | -- |
| ----- | Downstream of Yuba River on Left Bank | T270a<br>T270b | ----- | 39.108594 | -121.604663 | 8/19/08-~~9/26/10~~12/9/10 | -- |

[1] YCWA has installed redundant water temperature recorders at all locations except locations that are co-located with secure USGS stream flow gages or secure penstock sites.
[2] Water temperature data collected only when Lake Francis releases water.
[3] Co-located means that a flow gage may be in the vicinity of the water temperature recorder, but possibly not at the exact location.

### 5.3.1.2 Reservoir Water Temperature

Table 5.3.1-2 provides a list of locations at reservoir profiling will occur.

**Table 5.3.1-2. Reservoir profile locations by reservoir. Profiles taken about every 2 weeks from March through November, unless otherwise stated.**

| Reservoir | Location | Designation for Site | River Mile | Latitude | Longitude | Period of Record |
|---|---|---|---|---|---|---|
| **NORTH YUBA RIVER** | | | | | | |
| New Bullards Bar Reservoir | Approximately 100-200 feet upstream of center point of main dam | NY2.T455 | NYR 2.3 | 39.397148 | -121.135863 | About Every 2 Weeks from March through November from 08/25/89 to 5/2010 |
| **YUBA RIVER** | | | | | | |
| USACE's Englebright Reservoir | Approximately 100-200 feet upstream of center point of main dam | NY14.T455 | YR 24.0 | 39.240959 | -121.268811 | About Every 2 weeks from March through November from 01/24/90 to 5/2010 |
| USACE's Englebright Reservoir | Approximately3.3miles upstream of center point of main dam | -- | YR 27.2 | 39.276111 | -121.259497 | About Every 2 weeks from March through November |

### 5.3.1.3 Metrological Data

Table 5.4.1-3 identifies locations where YCWA or another party has installed and maintains a metrological station in the immediate vicinity of the Project.

**Table 5.3.1-3. Metrological stations by Project facility.**

| Project Facility | Location | Designation for Site | Elevation[1] | Latitude | Longitude | Parameter | Date Installed |
|---|---|---|---|---|---|---|---|
| **MIDDLE YUBA RIVER** | | | | | | | |
| Our House Diversion Dam | On Right Abutment of Dam | OHD[2] | 1,960 ft | 39.4120°N | 120.9964°W | Min, Max and Mean Daily Air Temp[2] | 12/19/06 to Present |
| | | | | | | Precipitation[2] | 12/19/06 to Present |
| **NORTH YUBA RIVER** | | | | | | | |
| New Bullards Bar Reservoir | On north bank about 0.25 ft Upstream of Dam | BUD[3] | 2,100 ft | 39.3963°N | 121.1439°W | Min, Max and Mean Daily Air Temp[3] | 11/16/09 to Present |
| | | | | | | Humidity[3] | 11/16/09 to Present |
| | | | | | | Wind Speed and Direction[3] | 11/16/09 to Present |
| | | | | | | Solar Radiation[3] | 11/16/09 to Present |
| | | | | | | Precipitation[3] | 11/16/09 to Present |
| **YUBA RIVER** | | | | | | | |
| New Colgate Powerhouse | On Deck of Powerhouse | CGT[4] | 600 ft | 39.3308°N | 121.1900°W | Min, Max and Mean Daily Air Temp[4] | 10/1/05 to Present |
| | | | | | | Precipitation[4] | 11/14/05 to Present |

[1] National Geodetic Vertical Datum of 1928.
[2] These data are available on the California Data Exchange Center (CDEC) under the Station ID name of "OHD" (Our House Dam).
[3] These data are available on the California Data Exchange Center (CDEC) under the Station ID name of "BUD" (Bullards Bar).
[4] These data are available on the California Data Exchange Center (CDEC) under the Station ID name of "CGT" (Colgate Powerhouse).

### 5.3.2 Step 2 – Install and Maintain Recorders and Download Data

Methods that will be used to install and maintain recorders, and collect data are described below. In general, anecdotal information that will be collected during each field visit to collect water temperature data will include: 1) general description of the weather; 2) start and end time of data collection; 3) air temperature at the start and end time of data collection; 4) maximum water depth where the observation is recorded; and 5) additional general comments regarding the data collection process. In addition, during initial installation of each recorder, YCWA will prepare a narrative description of each site, including the specific locations of recorders, and has taken photographs of each location.

At this time. Licensee intends to remove all water temperature recorders above Englebright Reservoir in late October 2012. Prior to removing the recorders, License will consult with Relicensing Participants regarding the need to maintain any gages for the purpose of water temperature modeling (See the Water Temperature Modeling Study).

#### 5.3.2.1 Stream Water Temperature

Continuous water temperature will be recorded every 15 minutes at the 33 sites listed in Table 5.4-1: 22 are located within the active streams; 9 of these are co-located and are installed within USGS steam flow gaging structures; and two are located in powerhouse penstocks. In addition, YCWA will collect continuous water temperature on one-hour intervals at five locations, two of which are co-located with a USGS gage.

**Water Temperature Recorders in the Active Channel**

The stream water temperature recorders in the active flow channel will have 12-bit resolution with a minimum accuracy of +/- $0.2^{o}$ C (i.e., Onset or equivalent). Each stream recorder will be contained in a durable protective housing that permits the active flow of water in and around the unit. Each stream recorder will be secured by a cable to a stable root mass, tree trunk or man-made structure, or secured using embedded rebar where necessary such that the recorder will be secured in the channel during high flow periods. The stream recorders will be installed in the channel thalweg, and the housing and cable will be disguised as much as possible while ensuring the ability to retrieve the unit for future downloads. A GPS coordinate will be taken and recorded at each installation point, along with any waypoints that may prove valuable for future retrieval, especially where there is not a defined trail leading to the access point. Photographs of the recorder site, including installation configuration, will be taken. Each recorder will be set to record water temperature at 15 minute intervals. Licensee will visit each recorder and downloads data at least monthly.

Prior to installation, each recorder will be numbered and calibrated to manufacturer's recommended specifications. Licensee will install a redundant water temperature recorder at each site. Redundant recorders will be located as close as possible to the primary recorders. Where a redundant recorder occurs, the primary recorder will be labeled with the recorder number for the site (*e.g.*, "T100") with the suffix "a" and the redundant recorder with the number for the site with the suffix as "b". Data from both recorders will be downloaded during each

scheduled visit. Data from higher elevation recorders subject to being snowbound or inaccessible due to high spring flows or requiring difficult access will be downloaded as soon as possible each spring and again prior to winter storms.

During each visit, Licensee will download data into an optic shuttle or directly to a personal computer. Immediately after the data are safely downloaded, back-ups will be recorded on compact disc (CD) or other suitable medium. Only after the raw water temperature data are safely backed-up will the optic shuttle be cleared or the data manipulated.

Prior to each download of data, a National Institute of Standards and Technology (NIST) traceable digital thermometer will be used to determine the water temperature at the recorder. The water temperature reading from the NIST-traceable thermometer will be compared to the last logger reading to check for accuracy drift of the recorder.

In addition, during each site visit, YCWA will be prepared to replace or fix a recorder installation. Should a recorder need to be replaced because it is missing or has failed, YCWA will be able to do so immediately to reduce the potential for additional data loss. Any recorder or optic shuttle that fails to download will be returned to the manufacturer for possible data recovery.

During each visit besides downloading data from the recorder, YCWA will also check equipment operation/calibration, battery life, and calibrate the instrument to manufacturer's specifications. After the recorder is removed from the water, it will be cleaned and visually inspected.

YCWA will maintain a record of all recorder installations and data downloads for a comparison between the NIST-traceable thermometer and recorder water temperature readings, and a record of any problems that were encountered in the field.

**Water Temperature Recorders in Stream Margins**

After the first Special-Status Amphibians – Foothill Yellow-Legged Frog (FYLF) Study (Study 3.4) survey effort (e.g., for egg masses), Licensee will install three to four continuous water temperature recorders at each of up to four locations upstream of Englebright Reservoir. Licensee and Relicensing Participants will collaboratively agree on each specific location and the siting of the specific recorders, with a goal that each location is: 1) in the margin of the stream channel (e.g., edge of runs, pool tailouts, and backwater pools/eddies at the top or bottom of lateral and median cobble bars); 2) in potential or known occupied FYLF habitats; and 3) if possible, near an existing water temperature recorder (Table 5.3.1-1). If possible, the recorders will also be located where a Channel Morphology Study (Study 1.1) cross-section is located.

The recorders will be installed in series at each location with one recorder near the water's edge (shallow) one in somewhat deeper (mid depth), and one in deeper water (deep). Licensee will install a pressure transducer at the deep water recorder. It is the intent that at least the shallow and mid depth recorder are in locations that represent FYLF egg laying habitat. Licensee will establish a benchmark at water's edge when the recorders are first installed, and the location and

depth of each recorder in relation to the benchmark and water's edge will be recorded. The target depth of the shallow recorder is 12 to 44 cm.

The recorders will be maintained as described above for Water Temperature Recorders in the Active Channel.

**Water Temperature Recorders at USGS Streamflow Gage Sites**

As shown in Table 5.4-1, YCWA will maintain 11 continuous water temperature recorders at USGS stream flow gaging sites. Data will be collected hourly by means of a Waterlog H-350 XL Instrument. Gages will be maintained by YCWA through a contractor. Data is stored in a data logger and downloaded monthly.

**Water Temperature Recorders in Powerhouse Penstocks**

YCWA will maintain two continuous water temperature recorders in powerhouse penstocks: one at the New Colgate Powerhouse and one at the Narrows 2 Powerhouse. Hourly temperature data will be collected by means of Honeywell Truline device, which trends the data on a chart-recorder and also transmits the data to the Narrows 2 Powerhouse Supervisory Control and Data Acquisition (SCADA) system.

5.3.2.2 Reservoir Water Temperature

Reservoir profiles will be taken at New Bullards Bar and USACE's Englebright reservoir at a target frequency of about every 2 weeks year round. Sampling will occur at one location near the dam in New Bullards Bar and in Englebright Reservoir, at one location near the dam and one location approximately 3.3 miles upstream of the dam. A GPS receiver will be used during each successive sampling occasion to locate the geographical coordinates of each sample site. Care will be taken to identify the same site for successive profiles where water conditions and GPS accuracy allow.

Prior to mid 2010, YCWA measured reservoir water temperature by use of a Fluke 50S K/J thermometer. The device was lowered in 10-ft intervals, allowed to stabilize, and then a recording was made. The maximum depth sampled in New Bullards Bar Rservoir was 300 ft or the bottom, whichever was less, and the maximum depth sampled in USACE's Englebright Reservoir was 100 ft or the bottom, whichever was less.

Beginning in mid 2010, Licensee will use a Hydrolab® DataSonde 5® multi-parameter water quality monitoring system (or equivalent) to measure water temperature (±0.2° C) and dissolved oxygen (±0.2 milligrams per liter (mg/l) at each of the reservoir sampling sites. Dissolved oxygen (DO) will be calibrated at each reservoir following the manufacturer's calibration protocols. Generally, measurements will be taken at 10-foot vertical increments where the change in temperature with respect to depth is low. Where the temperature gradient is higher or where measuring an interflow or an underflow, 5-foot or smaller vertical increment will be used. At each sample depth, the parameter readings will be allowed to stabilize before water temperature and DO will be recorded on the data sheet. When possible, profiling will occur up

to a depth of about 300 feet or the bottom, whichever is less, in New Bullards Bar Reservoir, and 120 feet or the bottom, whichever is less, in USACE's Engelbright Reservoir.

Also beginning in mid 2010, Licensee will collect with each reservoir water temperature profile a Secchi disk depth reading as an indicator of water clarity and photic zone. Secchi depth readings will be taken by lowering a Secchi disc over the shaded side of the boat until the disc is no longer visible from the boat. The disk will then be raised until visible, at which location the depth of the disc will be recoded in tenths of a foot.

5.3.2.3 Metrological Data

The stations at Our House Diversion Dam, New Colgate Powerhouse and New Bullards Bar Dam are operated and maintained by the California Department of Water Resources (CDWR) with data collected by satellite. Hourly data is available on the CDEC website under OHD (Our House Dam), CGT (Colgate Powerhouse), and BUD (New Bullards Bar Dam).

### 5.3.3 Step 3 – Perform QA/QC Review of Data

Following data collection, YCWA will subject all data to a quality assurance/quality control (QA/QC) procedures including, but not limited to: 1) checking field data sheets (*e.g.*, comparison of NIST-traceable thermometers and recorder readings) to be sure no corrections are needed; and 2) spot-checking data, 3) reviewing recorder readings and electronic data for completeness. The datasets will also be reviewed graphically to check for errors. If any datum seems inconsistent during the QA/QC procedure, YCWA will investigate the problem. Values that are determined to be anomalous will be removed from the database if the reason for the reading cannot be identified.

If data are unavailable for brief periods of the record, the missing data will be synthesized into the record using a straight line interpolation method, and the data will be indicated as "synthesized" in the record and all subsequent summaries.

The raw data files will be retained in their unaltered state for future QA/QC reference. And data modified in the final record will be so indicated in the record.

### 5.3.4 Step 4 – Prepare Report

At the conclusion of the study, YCWA 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 include, in Microsoft Excel and DSD format, on compact disc (CD) all data in mean daily increments except for reservoir profile data that will be in instantaneous readings. The final report will also include plots of steam water temperature showing mean daily water temperatures over time with mean daily stream flow at as site nearby the monitoring site, if available. Plots of water temperature and DO reservoir profiles will also be included in the report.

## 6.0 Study-Specific Consultation

This study includes one study-specific consultation.

- Prior to removing all water temperature recorders above Englebright Reservoir in late October 2012, License will consult with Relicensing Participants regarding the need to maintain any gages for the purpose of water temperature modeling (See the Water Temperature Modeling Study). (Step 2).

## 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 September 16, 2011 and the study is not disputed by a mandatory conditioning agency~~October 4, 2011~~:

Identify Sites and Install Recorders (Steps 1 & 2) .....October 2011
Maintain Recorders and Download Data (Step 2) ..... November 2011 - Late October 2012
Data QA/QC (Step 3)..... November & December 2012
Prepare Report (Step 4).....January & February 2013

## 8.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methodologies described above for water temperature monitoring, reservoir profiling, and meteorological 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

Office of Environmental Health Hazard Assessment (OEHHA). 2003. Draft Report and Health Advisory for Fish from Selected Water Bodies in the Bear River, South Yuba River, and Deer Creek Watersheds (Nevada, Placer, and Yuba Counties) a fact sheet by Office of Environmental Health Hazard Assessment - California Environmental Protection Agency. February http://www.oehha.ca.gov/public_info/facts/fishfacts.html

State Water Resources Control Board (SWRCB). 2006. 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments. Central Valley Regional Water Quality Control Board. Approved by the SWRCB: October 25, 2006. http://www.swrcb.ca.gov/tmdl/303d_lists2006.html

Study 3.4

# SPECIAL-STATUS AMPHIBIANS – FOOTHILL YELLOW-LEGGED FROG SURVEYS

February 11, 2011

## 1.0 Project Nexus

Yuba County Water Agency's (YCWA or Licensee) continued operation and maintenance (O&M) of the Yuba River Development Project (Project) has a potential to affect the special-status[1] amphibian, foothill yellow-legged frog (FYLF) (*Rana boylii*), which is considered a State Species of Special Concern by the California Department of Fish and Game (CDFG).

## 2.0 Resource Management Goals of Agencies with Jurisdiction Over the Resource to be 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 Licensee 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 Study Goals and Objectives

The goal of this study is to develop information concerning the special-status amphibians associated with Project-affected stream reaches, and related Project recreation features or activities.

The specific objectives of this study are as follows:

[1] Special-status amphibians are considered those species: 1) formally listed by the United States Department of Agriculture Forest Service as a Sensitive Species or a Management Indicator Species; 2) listed under the federal Endangered Species Act (ESA) as Proposed or a Candidate for listing as endangered or threatened or proposed for delisting; 3) listed under the California Endangered Species Act (CESA) as Proposed for listing as endangered or threatened or proposed for delisting; or 5) formally listed by California Department of Fish and Game as a Species of Concern. For the purpose of this study proposal, species listed as threatened or endangered under the ESA or CESA are addressed separately.

- Identify, compile, and map known occurrences of FYLF, including life history stage and associated habitat information as available. At a minimum, produce a map of known occurrences with a supplemental table that includes information on the exact location, date found, how many individuals (if available), and the source of the sighting (museum database, agency record, etc.).
- Identify habitats in the study area potentially suitable for FYLF, and evaluate the suitability of these habitats for the species.
- Perform biological surveys in suitable habitats and determine approximate period in which breeding and rearing occurs if FYLF is found.
- Compile incidental observations from other aquatic studies documenting other native amphibians, and non-native aquatic species that may affect the distribution of FYLF.

# 4.0 Existing Information and Need for Additional Information

Existing and relevant information regarding known and potentially occurring locations of special-status amphibians in the Project Vicinity[2] are available from California Natural Diversity Database (CNDDB), museum records, and other sources. FYLF is the only special-status amphibian in the area. Information and a life history description of FYLF, included in Section 7.3 of Licensee's Preliminary Information Package (YCWA 2009), is useful in identifying preferred habitats and documenting where the species have been found to date. Table 4.0-1 summarizes habitat requirements of FYLF by life stage.

**Table 4.0-1. Foothill yellow-legged frog habitat requirements by life stage.**

| Egg Masses[1] | Larvae[1] | Juveniles and Adults[1] |
|---|---|---|
| Egg masses are deposited in low to moderate gradient streams, usually within shallow, edgewater areas of low velocity with cobble/boulder substrate in open, sunny areas with little riparian vegetation; often adjacent to low gradient cobble/boulder bars, tributary confluences, side and backwater pools, or pool tail-outs with coarse substrates. In small streams may occur in step pools and other microhabitats that meet basic conditions for substrate, water depth, and velocity. | Generally in low velocity segments of streams, such as edgewater habitat adjacent to riffles or cascades, in main channel pools, and plunge-pools that provide escape cover (e.g., substrate interstices, vegetation, and detritus for cover). Larvae, at least in early stages, show affinity to oviposition sites, but may disperse to shallow, warm, low velocity near-shore habitats with smaller substrate (i.e., gravel/sand) as the season progresses. | Perennial streams and ephemeral creeks with pools. Prefer areas that provide exposed basking sites and cool shady areas adjacent to water's edge. Shallow, flowing water, preferentially in small to moderate-sized streams with some cobble-sized substrate. |

[1] Sources of information: Jennings and Hayes 1994, PG&E 2001, Lind 2005.

FYLF is a stream-adapted species and is not associated with ponds, lakes, or other lentic habitats. Within large streams, FYLF often occurs near tributaries, which may provide important seasonal habitats (e.g., in winter and during the hottest part of the summer) (VanWagner 1996; Seltenrich and Pool 2001). Breeding tends to occur in spring or early summer and eggs are laid in areas of

[2] For the purposes of the Relicensing, the Project Vicinity is defined as the area surrounding the Project in the order of a county or United States Geological Survey 1:24,000 topographic quadrangle.

shallow, slow moving, waters near the shore. FYLF are infrequent in habitats where introduced fish and American bullfrog occur (Jennings et al. 1994).

The CNDDB (CDFG 2003) reports 24 occurrences of FYLF in the Project Vicinity. The records cited by Vindum and Koo (1999) for the drainages of the North, Middle, and South Yuba rivers occur above Project-affected reaches. California Academy of Sciences (2010) has 17 FYLF records from Sierra County, seven from Yuba County, and six from Nevada County. The Museum of Vertebrate Zoology has nine specimens from Yuba County. Despite widespread documentation of FYLF in the region, few of these records are from the Project Area.[3] In the vicinity of Log Cabin Diversion Dam on Oregon Creek, there are records for FYLF (adults and subadults); FYLF also have been documented upstream and downstream of Our House Diversion Dam on the Middle Yuba River. Tahoe National Forest reports 150 occurrences of FYLF within 10 miles of the Project Vicinity; at least 16 of which are located in the Project Area. Most of the records are in the vicinity of Oregon Creek, North Yuba River, Kanaka Creek, Grizzly Creek, Woodruff Creek, Grizzly Gulch, and the Middle and South Yuba rivers. Other areas with multiple TNF FYLF records include Blue Ravine, Deer Creek, Devils Canyon, Fiddle Creek, Hornswoggle Creek, Humbug Creek, Indian Creek, Moores Flat, Rapps Ravine, and Willow Creek. During stream habitat mapping in 2009, Licensee observed FYLF in Oregon Creek and in Middle Yuba River downstream of Our House Diversion Dam.

In most cases, existing information is too general to meet the objectives of the study. Additional information needed includes specific and current localities of FYLF~~each of the species~~ and its~~their~~ habitat~~s~~ in relation to Project facilities; and sufficient information on normal Project O&M activities that might affect populations.

# 5.0 Study Methods and Analysis

## 5.1 Study Area

The study area consists of stream reaches affected by the Project; it also includes tributaries unaffected by the Project up to 0.5 mile (mi) upstream from the normal high water line of Project-affected stream reaches, if suitable habitat for FYLF is accessible to the species from habitat in the mainstem of the river. This 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 Bullards 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 New Colgate Powerhouse. The Yuba River below New Colgate Powerhouse is below 600 feet (ft) in elevation and thus outside of the known or expected distribution of FYLF, which extends from about 600 ft to 5,000 ft in elevation (Moyle 1973, Seltenrich and Pool 2002, ECORP Consulting, Inc. 2005).

[3] For the purposes of this document, the Project Area is defined as the area within the existing Federal Energy Regulatory Commission (FERC) existing Project Boundary and the land immediately surrounding the FERC Project Boundary (*i.e.*, within about 0.25 mile of the FERC Project Boundary) and includes Project-affected reaches between facilities and downstream to the next major water controlling feature or structure.

In addition, the study area includes tributaries up to 1.0 mile (mi) upstream of New Bullards Bar Reservoir, Our House Diversion Dam Impoundment and Log Cabin Diversion Dam Impoundment if suitable habitat is accessible to the species from habitat in the reservoirs and impoundments. FYLF may make seasonal movements between tributaries and mainstem streams.

The study area also includes one study site on each of two stream reaches unaffected by the Project: 1) Oregon Creek immediately upstream of the Log Cabin Diversion Dam Impoundment, and 2) a stream reach in the Yuba River watershed with comparable geomorphic attributes to at least some of the larger Project-affected stream reaches. The locations of these two study sites will be determined as described in Section 5.3.2.

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 completed in five steps, each of which is described below.

Prior to conducting field work, Licensee will obtain necessary CDFG scientific collection permits and will adhere to accepted decontamination guidelines to minimize the likelihood of transmitting diseases (USFWS 2005).

### 5.3.1 Step 1 – Map Occurrences

Licensee will map known occurrences of FYLF based on a query of the CNDDB, agency records, museum records, and consultation with regional experts. The map will be supplemented with a table that includes information on the exact location, date found, how many individuals (if available), and the source of the sighting (museum database, agency record, etc.).

### 5.3.2 Step 2 - Identify Potential Habitat and Select Survey Sites

Licensee will review available data sources to identify areas of potentially suitable habitat for FYLF (emphasizing potential breeding habitat) based on the description of habitat elements presented in Table 4.0-1. Data sources may include aerial photographs; the Project helicopter video, National Wetland Inventory (NWI) maps, United States Geological Survey (USGS) 1:24,000 topographic quadrangle, hydrologic data, and other sources of information that would allow for assessment of habitat conditions within the study area.

Licensee may conduct a field reconnaissance at specific locations to assess on-site habitat conditions if other data sources are not adequate to this purpose. Sites will be logged by GPS position, photographs will be taken of each site from various angles, and a preliminary habitat assessment will be conducted. Pertinent habitat characteristics to be recorded will include stream

channel form and dimensions, gradient, substrate types, and vegetation types (e.g., aquatic, emergent, overhanging, and canopy).

Following review of habitat data sources, a representative set of sites determined to be potentially suitable habitat or all sites, if few suitable sites are identified, will be selected for surveys. Although the number and locations of surveys sites cannot be determined in advance, it is anticipated that at least one site will be placed in each reach affected by the Project, with additional sites as needed to represent the range of conditions where FYLF may occur and potential types of Project effects in each reach; and a total of two sites will be placed in stream reaches unaffected by the Project. One of these non-Project-affected sites will be located in Oregon Creek immediately upstream of the Log Cabin Diversion Dam Impoundment. The other non-Project-affected site will be located in a stream reach in the Yuba River watershed with comparable geomorphic attributes to at least some of the larger Project-affected stream reaches. It is understood that the number of sites may be constrained by access limitations, such as occur in the North Yuba River from New Bullards Bar Dam to the Middle Yuba River, and in parts of the Yuba River.

Licensee will provide a summary of the information described above to the Relicensing Participants. No sooner than one week after providing the information to the Relicensing Participants, Licensee will meet with interested and available Relicensing Participants to collaborate with interested and available Relicensing Participants regarding sampling locations. 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. If collaborative agreement is not reached, Licensee will note the disagreements in its final report, including why Licensee did not adopt the recommendation.

The selection of survey sites will take into account site-specific conditions, including safety, accessibility (i.e., road or trail access, topography), permission from landowners to survey on private lands, and potential impact from Project O&M. Survey sites may be disproportionately located near (i.e., within 0.25 mi) of a confluence based on research that supports the importance of proximate tributaries as non-breeding habitat for FYLF associated with larger and/or higher elevation rivers (Kupferberg 1996, Van Wagner 1996, Marlow et al. 2007). Survey site length will range from 750 to 1,000 meters (2,461 to 3,281 ft) on the project-affected reach, based on the extent of suitable habitat and access. The same site dimensions will apply to the two non-Project-affected sites. To the extent reasonable, FYLF survey sites will be co-located with other relicensing study sites.

Licensee will invite interested and available Relicensing Participants into the field to comment on the final selection of survey sites.

### 5.3.3 Step 3 – Conduct Surveys

Surveys for FYLF will occur during the breeding season and will follow the VES standard protocols developed by Pacific Gas & Electric Company (PG&E) for hydroelectric project applications (PG&E and NID 2009), which are modified from Seltenrich and Pool (2002).

Specifically, two surveyors working in tandem will search along both banks of streams, back channel areas, and potential instream habitats for FYLF walking slowly while one observer scans ahead. Habitats along each bank will be searched. To aid in the detection of eggs and larvae, surveyors will use a viewing box in shallow margin areas. In water too deep to survey by wading, or where substrate configuration (e.g., large boulders) or other factors render the viewing box ineffective, snorkeling will be employed in appropriate habitats during searches where safely accessible. Each FYLF detection will be recorded by life stage along with the associated habitat data based on procedures described in PG&E and NID (2009), including water temperature, depth, and substrate characteristics. Detailed water velocity, depth, and substrate data (i.e., information pertinent to habitat suitability curve [HSC] development) will be collected for detections of tadpoles on Oregon Creek; at survey sites on the Middle Yuba, North Yuba, and Yuba River, these data will only be collected for a representative sub-set of tadpole detections. Egg mass locations will be recorded by GPS (ideally, Map Grade Trimble GPS) and flagged, photographed, and/or described sufficiently so that egg mass locations can be re-surveyed if the site is used for the performance of Study 3-4, Special-Status Amphibians – Foothill Yellow-Legged Frog Habitat Modeling. Tadpole locations will also be recorded by Map Grade Trimble GPS.

Three FYLF VES visits will be conducted at all sites; two visits in the spring/early summer for the detection of egg masses, and one in the summer to detect tadpoles. A fourth survey will be conducted at sites where egg masses and/or tadpoles were documented in any of the previous surveys; this fourth survey will be in late summer/early fall and intended to document late stage tadpoles and the post-metamorphic stage. The first survey will occur when water temperature monitoring data being collected in the Water Temperature Monitoring Study indicate that temperatures have reached a daily average of 51.8-53.6ºF (11-12ºC) (although FYLF has been reported to sometimes breed at water temperatures as low as 50ºF (10ºC) [Amy Lind, personal communication], a survey-trigger temperature of 51.8ºF should ensure that surveys are not initiated prematurely). Temperature data from the lowest elevation monitoring sites in reaches proposed for surveys will be used for this purpose. The onset of the breeding season may also be assessed by weekly observations at one or more "sentinel sites" in the Middle Yuba, North Yuba, and/or Oregon Creek (i.e., locations in or near the study area where FYLF breeding activity can be easily monitored), if there are locations in these streams where FYLF is known to breed. Sentinel site monitoring would begin in April, and observations of gravid female FYLF or egg masses at these sites may also provide a trigger to initiate the surveys in other locations. As noted in Section 5.2 (General Concepts and Procedures), incidental observations of certain other species will be reported in the study report(s) appropriate to the species. The standard protocols for FYLF VES require recording observations of all amphibians or reptiles that are observed during the VES, including the approximate number and the life stage(s) present. Following the initial VES, surveyors will complete a habitat characterization of each study location, following standard operating procedures.

### 5.3.4 Step 4 – Prepare, Format and Quality Assurance/Quality Control Data

Following field surveys, Licensee will develop GIS maps depicting special-status species occurrences, potential habitat, project facilities and features, and other information collected during the study. Field data will then be subject to quality assurance and quality control

(QA/QC) procedures, including spot-checks of transcription and comparison of GIS maps with field notes.

### 5.3.5 Step 5 – Prepare Report

Licensee will prepare a report that includes the following sections: 1) Study Goals and Objectives; 2) Methods and Analysis; 3) Results; 4) Discussion; and 5) Description of Variances from the FERC-approved study proposal, if any. At a minimum, the following summaries/data presentations will be provided, along with the supporting data (in Excel spreadsheet and GIS layers, as appropriate):

- Presence/absence of FYLF by survey period (e.g., spring, summer), sample reach tributary, and river
- Abundance of FYLF egg masses by survey period, sample reach tributary, and river
- Abundance of FYLF tadpoles/tadpole groups by survey period, sample reach tributary, and river
- Abundance of FYLF young of the year (metamorphs), subadults, and adults by survey period, sample reach tributary, and river
- Descriptive summaries of FYLF egg mass and tadpole habitat characteristics (at least n, mean, minimum, maximum, and standard error values) overall and by river and/or tributary
- Summary and maps of site habitat assessments
- Maps depicting the number of FYLF observations by life stage at each survey site
- The report will also include pertinent water temperature data, including margin temperatures collected during the Water Temperature Monitoring Study (Study 2.5).

For all special-status species observations, Licensee will complete the appropriate CNDDB form and transmit the form to the CNDDB.

### 5.3.6 Step 6 – Collaboration Regarding Need for and Scope of Focused Studies in Second Year

Licensee will meet with interested and available Relicensing Participants no later 6 weeks prior to the date that Licensee's Initial Study Report is scheduled to be filed with FERC to review data available from the study at that time and discuss the need for and scope of additional limited scope studies. For example, if the study documents only post-metamorphic life stages of FYLF (adult, juvenile, or young-of-year) or if only late stage larvae are detected (i.e., the results do not indicate where FYLF breeding occurred), further focused survey for egg masses and/or early tadpoles in the same stream may be appropriate. In addition, if incidental observations of invasive bullfrogs (*Lithobates* [*Rana*] *catesbeianus*) and crayfish, known predators of FYLF, collected by Licensee during this study and other relicensing studies suggests that these species occur in numbers that could adversely affect FYLF and their occurrence is related to the Project, focused studies for these species may be needed. These focused studies could determine their

extent/distribution, relative abundance, and lifestage distribution within Project-affected reaches. VES methods for FYLF can be adapted for bullfrog surveys in lotic waters. For crayfish, PG&E's Pit 3,4,5 FYLF monitoring plan could provide examples of methods for counting. These are only examples, and other conditions or circumstances may indicate a need for other focused studies of a particular site. If Licensee and Relicensing Participants collaboratively agree focused studies are needed in a second year, Licensee and Relicensing Participants will collaboratively develop a new study proposal and Licensee will file it with FERC prior to or at the same time Licensee files its Initial Study Report, and implement the study as directed by FERC.

## 6.0 Study-Specific Consultation

Licensee will engage in the following study-specific consultation:

- Licensee will collaborate with Relicensing Participants regarding study site locations and ~~Licensee~~ will invite interested and available Relicensing Participants into the field to comment on the final selection of study sites.

- Licensee will collaborate with Relicensing Participants regarding need for focused second year studies as discussed in Step 6.

## 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 September 16, 2011 and the study is not disputed by a mandatory conditioning agency~~October 4, 2011~~:

Identify Habitat and Select Survey Sites (Step 1)..... October 2011 – March 2012
Conduct Surveys (Step 2) ..... March 2012 – August 2012
QA/QC (Step 3) ..... ~~September~~ August 2012
Report Preparation (Step 4) ..... ~~September~~ August 2012 - ~~October~~ September 2012

## 8.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is consistent with the goals, objectives, and methods outlined for recent FERC hydroelectric relicensing efforts in California, and uses well established data from CDFG and other reputable sources for the analysis.

## 9.0 Level of Effort and Cost

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

# 10.0 References Cited

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Study 3.8

# STREAM FISH POPULATIONS UPSTREAM OF ENGLEBRIGHT RESERVOIR

February 11, 2011

## 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, however New Bullards Bar Reservoir has been planted with hatchery stock Kokanee, Eagle Lake trout, and rainbow trout and Englebright Reservoir has been planted with rainbow trout. ~~.~~ 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 as well as an MOU if handling ~~for streams that do not contain ESA-listed~~ species listed as threatened or endangered under the Endangered Species Act is anticipated.~~.~~ 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 | Reach Length (mi) | General Location |
|---|---|---|---|
| North Yuba River | New Bullard's Bar Dam Reach | 2.3 | 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 | n/a | Site located proximally to Log Cabin Diversion Dam, if possible within 0.5 mile |
| | Log Cabin Diversion Dam Reach | 4.1 | 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 | n/a | Site located within 0.5 mile upstream of Our House Diversion Dam Reach |
| | Our House Diversion Dam Reach | 7.5 | 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 | 4.5 | Site located proximally to Moonshine Creek near RM 3.4. |
| Yuba River | Middle/North Yuba River Reach | 5.8 | 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 | 1.7 | 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~~available when the sites are ~~seleted~~selected 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 using three--pass--depletion.~~.~~

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, turbidity, flow conditions during data collection, 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. Qualitative electrofishing will occur on the margins of quantitatively snorkeled sites to provide length and weight data, following the snorkel assessment. These data will be used to develop a condition factor.

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 midday~~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 September 16, 2011 and the study is not disputed by a mandatory conditioning agency~~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]

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Study 5.1

# SPECIAL-STATUS PLANTS

February 11, 2011

## 1.0 Project Nexus

Yuba County Water Agency's (YCWA or Licensee) continued operation and maintenance (O&M) of the Yuba River Development Project (Project) may have an effect on special-status[1] plants.

As part of this study, Licensee will also record incidental observations of noxious weeds, as well as United States Department of Agriculture, Forest Service (Forest Service) Sensitive Fungi and Watchlist Plant Communities.

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

The following was provided to Licensee by the ~~United States Department of Agriculture, Forest Service (~~Forest Service~~)~~ as a description of the Forest Service's management goals for special-status plants on National Forest System (NFS) land as identified in the National Forest Management Act (NFMA, public Law 94-588 1976) and the Tahoe National Forest (TNF) Land and Resource Management Plan (TNF LRMP) (USDA Forest Service 1990), as amended by the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001~~a and 2001b~~) and the Supplemental Sierra Nevada Forest Plan Amendment (USDA Forest Service 2004~~a and 2004b~~):

- Region 5, Regional Forester's Sensitive Species: Manage Region 5 Regional Forester's sensitive species to ensure that species do not become federally listed as threatened or endangered. Coordinate with YCWA so that management activities within the FERC boundary evaluate the potential impacts of projects to sensitive species, and address measures for maintaining viable populations and possible alternatives to mitigate or avoid impacts.

- Plumas National Forest (PNF) and TNF Watch List Plants and Plant Communities: Manage PNF and TNF Watch List plants and plant communities so they are conserved and contribute to the diversity of plants and plant habitats on the Forest.

[1] ~~For the purposes of this Relicensing, special-status plants are considered those plants that are: 1) found on National Forest Service (NFS) land managed by the United States Department of Agriculture, Forest Service (Forest Service) and formally listed on the Forest Service's List of Sensitive Plant Species for the Plumas National Forest (FSS-P) or the Tahoe National Forest (FSS-T) or as a Watch List Species by the Plumas National Forest (FW-P) or the Tahoe National Forest (FW-T); 2) found on the California Department of Fish and Game's (CDFG)'s list of California Rstate listed rare (SR) species, listed under the Native Species Protection Act of 1977; 3) listed under the federal ESA as a Ccandidate for listing as endangered (FPE) or threatened (FPT); 4) listed under the CESA as proposed for listing as endangered or threatened; or 5) found on the California Native Plant Society (CNPS) Inventory of Rare Plants and formally listed as a CNPS 1, 2 3 or 4 plant (CNPS 1, CNPS 2, CNPS 3, CNPS 4). Special status plants do not include plants that are listed as threatened or endangered under the ESA or CESA, which are addressed separately for the purpose of the Relicensing.~~

# 3.0 Study Goals and Objectives

The goal of this study is to provide information to determine whether continued Project O&M or recreational use of Project facilities may have an adverse effect on special-status plant species.

The objective of this study is to gather the information necessary to perform this analysis.

# 4.0 Existing Information and Need for Additional Information

## 4.1 Special-Sstatus Plants

For the purpose of this Relicensing, special-status plants are those plants that have a reasonable possibility of occurring in the Project Area and meets one or more of the following criteria:

- Found on NFS land managed by the Forest Service and formally listed as Forest Service Sensitive Plant species for the PNF (FSS-P) or the TNF (FSS-T) or as a Forest Service Watch List species by the PNF (FW-P) or the TNF (FW-T).
- Found on the California Department of Fish and Game (CDFG) Commission's *State and Federally Listed Endangered, Threatened, and Rare Plants of California* (CDFG 2010), including those that are state-listed rare (SR) or a state candidate (SC) for listing species listed under the Native Species Plant Protection Act of 1977 (CDFG 2010b).
- Found on the list of species proposed for listing under the federal Endangered Species Act (ESA), including species that are proposed for listing as endangered (FPE) or threatened (FPT), a candidate for listing (FC), or proposed for delisting (FPD).
- Found on the California Native Plant Society's (CNPS) *Inventory of Rare and Endangered Plants*, including species that are rated as CNPS 1A or CNPS 1B through 4B (CNPS 2010).

Fully protected botanical species listed under CESA and ESA are not considered special-status for the purpose of the Relicensing, but are addressed separately in CESA-Listed Plants Study 7.5, and the ESA-Listed Plants Study 7.1. These species include those plants that are state threatened (ST) or endangered (SE) under the CESA, or federally threatened (FT) or endangered (FE) under the ESA.

As discussed in section 7.5 of Licensee's Preliminary Information Package (YCWA 2009), existing and relevant information regarding known and potentially occurring special-status plants in the Project Vicinity[2] is available from the California Natural Diversity Database (CNDDB) (CDFG 20092011), and ~~California Native Plant Society (~~CNPS~~)~~ Inventory of Rare and Endangered Plants database (CNPS 20092011), as well as TNF and ~~Plumas National Forest (~~PNF~~)~~ records. Based on this information, Licensee identified ~~36~~ 764 plants species that are

[2] For the purposes of the Relicensing, the Project Vicinity is defined as the area surrounding the Project in the order of a county or USDOI, United States Geological Survey (USGS) 1:24,000 topographic quadrangle.

listed as special-status and have a reasonable potential to occur on the Project. Table 4.10-1 provides for each of the special-status plant species: 1) status; 2) flowering period; 3) elevation range; 4) habitat requirements; and 5) documented occurrence in the Project Vicinity. The list has been developed as a guide of species likely to occur within the Project Boundary; however, all special-status plant species located during Project surveys will be mapped and reported.

**Table 4.10-1. Special-status plants known or with the potential to occur in the Project Vicinity.**

| Common Name/ Scientific Name | Status[1] | Flowering Period | Elevation Range (ft) | Habitat Requirements | Occurrence in Project Vicinity[2] |
|---|---|---|---|---|---|
| Henderson's bent grass *Agrostis hendersonii* | FW-P CNPS 3 | Apr-Jun | 200-1,000 | Valley and foothill grasslands, vernal pools | Present in the Project Vicinity, including Brush Creek quadrangle |
| Jepson's onion *Allium jepsonii* | FSS-P CNPS 1B | Apr-Aug | 950-4,500 | Chaparral, cismontane woodland, lower montane coniferous forest | Potential to occur in the Project Boundary |
| Sanborn's onion *Allium sanbornii* var. *congdonii* | FW-T FW-P CNPS4 | Apr-July | 950-3,250 | Cismontane woodland, lower montane coniferous forest | Present in the Project Vicinity, including the Washington quadrangle |
| Sanborn's onion *Allium sanbornii* var. *sanbornii* | FW-T CNPS 4 | May-Sept | 850-5,000 | Chaparral, cismontane woodland, serpentine | Present in the Project Vicinity, including the Challenge, Nevada City, Clipper Mills, Rackerby, and Washington quadrangles |
| True's manzanita *Arctostaphylos mewukka* ssp. *truei* | FSS CNPS 4 | Feb-July | 1,400-4,550 | Chaparral, lower montane coniferous forest, sometimes roadside | Potential to occur in the Project Boundary |
| Nissenan manzanita *Arctostaphylos nissenana* | FSS CNPS 1B | Feb-Mar | 1,400-3,650 | Closed-cone coniferous forest, chaparral | Potential to occur in the Project Boundary |
| Webber's milk-vetch *Astragalus webberi* | FSS-T CNPS 1B | May-Jul | 2700-4000 | Lower montane coniferous forest | Potential to occur in the Project Boundary |
| Big-scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis* | CNPS 1B | Mar-Jun | 300-4,600 | Chaparral, cismontane woodland, and valley and foothill grassland, sometimes serpentine | Present in the Project Vicinity, including the Brush Creek quadrangle |
| Constance's rockcress *Boechera constancei* [*Arabis constancei*] | FSS-P CNPS 1B | May-July | 2,600-6,650 | Chaparral, lower montane coniferous forest, upper montane coniferous forest, serpentine soils | Present in the Project Vicinity, including the La Porte quadrangle |
| Threadleaf beakseed *Bulbostylis capillaris* | FW-P CNPS 4 | Jun-Aug | 1,300-6,800 | Lower montane coniferous forest, meadows and seeps, upper montane coniferous forest | Potential to occur in Project Boundary |
| Butte County western rosinweed *Calycadenia oppositifolia* | FSS-P CNPS 4 | Apr-Jul | 300-3,100 | Chaparral, cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland and volcanic, granitic or serpentine soils | Potential to occur in Project Boundary |
| Nightblooming false bindweed *Calystegia atriplicifolia* ssp *buttensis* | FSS-P CNPS 4 | May-July | 1,950-5,000 | Chaparral, lower montane coniferous forest, rocky soil, sometimes roadside | Potential to occur in Project Boundary |
| Siskiyou sedge *Carex gigas* | FSS-P CNPS 4 | May-July | 2,350-7,700 | Mesic, sometimes serpentine seeps, lower montane coniferous forest, meadows and seeps, upper montane coniferous forest | Potential to occur in Project Boundary |
| Mendocino sedge *Carex mendocinensis* | FSS | May-July | 500-5,250 | Moist areas, often serpentine | Potential to occur in Project Boundary |

**Table 4.10-1. (continued)**

| Common Name/ Scientific Name | Status[1] | Flowering Period | Elevation Range (ft) | Habitat Requirements | Occurrence in Project Vicinity[2] |
|---|---|---|---|---|---|
| Dissected-leaved toothwort *Cardamine pachystigma* var. *dissectifolia* | FW-P CNPS 3 | Feb-May | 800-6,900 | Chaparral, lower montane coniferous forest | Present in the Project Vicinity, including Cascade , Brush Creek, Strawberry, Camptonville and Forbestown quadrangles |
| Red Hills soaproot *Chlorogalum grandiflorum* | FSW-T CNPS 1B | May-Jun | 800-3800 | Chaparral, cismontane woodland, lower montane coniferous forest, serpentine or gabbro soils | Potential to occur in Project Boundary. |
| Brandegee's clarkia *Clarkia biloba* ssp. *brandegeeae* | FSS-P FSS-T CNPS 1B | May-Jul | 200-3,000 | Chaparral, cismontane woodland, often roadcuts | Present in the Project Vicinity, including Pike, Camptonville, Challenge, French Corral, and Oregon House quadrangles |
| White-stemmed clarkia *Clarkia gracilis* ssp. *albicaulis* | FSS-P CNPS 1B | May-Jul | 800-3,500 | Chaparral, cismontane woodland, sometimes serpentine | Present in the Project Vicinity, including the Forbestown quadrangle |
| Mildred's fairyfan *Clarkia mildrediae* ssp. *lutescens* | FW-P CNPS 4 | Jun-Aug | 900-5,750 | Cismontane woodland, lower montane coniferous forest, often roadcuts | Present in the Project Vicinity, including Cascade, Clipper Mills, Bush Creek and Strawberry Valley quadrangles |
| Mildred's clarkia *Clarkia mildrediae* ssp. *mildrediae* | FSS-P CNPS 1B | May-Aug | 800-5,600 | Cismontane woodland, lower montane coniferous forest/sandy, usually granitic | Present in the Project Vicinity, including the Brush Creek quadrangle |
| Mosquin's clarkia *Clarkia mosquinii* | FSS-P CNPS 1B | May-Jul | 600-4,000 | Cismontane woodland, lower montane coniferous forest/rocky, roadsides | Present in the Project Vicinity, including Clipper Mills, Strawberry Valley, Cascade, and Brush Creek quadrangles |
| MacNab's cypress *Cupressus macnabiana* | FW-P | --- | 900-2,750 | ChapparelChaparral, oak woodland, coniferous woodlands, serpentine or infertile soils | Potential to occur in Project Boundary |
| California lady's slipper orchid *Cypripedium californicum* | FW-P CNPS 4 | Apr-Aug | 100-9,000 | Bogs and fens, lower montane coniferous forest seeps and streambanks, usually serpentine | Present in the Project Vicinity, including La Porte and Strawberry Valley quadrangles |
| Clustered lady's-slipper *Cypripedium fasciculatum* | FSS-T FSS-P CNPS 4 | Mar-Aug | 500-7200 | Lower montane coniferous forest, North Coast coniferous forest, mixed conifer | Potential to occur in Project Boundary |
| Mountain lady's-slipper *Cypripedium montanum* | FSS-T CNPS 4 | Mar-Aug | 600-7500 | BroadleafedBroad-leafed upland forest, cismontane woodland, lower montane coniferous forest, North Coast coniferous forest, mixed conifer | Potential to occur in the Project Boundary |
| Northern yellow lady's-slipper *Cypripedium parviflorum* var. *makasin* | CNPS 3 | May-Aug | Below0 4,900 | Bogs and fens, meadows and seeps | Present in Project Vicinity, including the Strawberry Valley quadrangle |
| California pitcher plant *Darlingtonia californica* | FW-T FW-P CNPS 4 | Apr-Jul | Below 8,500 | Bogs and fens, meadows and seeps, generally serpentinite seeps | Present in the Project Vicinity, including the Goodyear's Bar, quadrangle |
| English sundew *Drosera anglica* | FW-T CNPS 2 | Jun-Sep | 4,250-6,650 | Bogs and fens, meadows and seeps | Potential to occur in the Project Boundary |
| Round-leaved sundew *Drosera rotundifolia* | FW-T FW-P | Jun-Sep | Below 6,650 | Bogs and fens, meadows and seeps | Potential to occur in the Project Boundary |
| Norris' beard moss *Didymodon norrisii* | FW-P CNPS 2 | --- | 1,950-6,400 | Cismontane woodland, lower montane coniferous forest | Potential to occur in Project Boundary |
| Dwarf downingia *Downingia pusilla* | CNPS 2 | Mar-May | 0- Below1,400 | Valley and foothill grassland, vernal pools | Potential to occur in Project Boundary |
| Clifton's eremogone *Eremogone cliftonii* | FW-P CNPS 1B | Apr-Sep | 1,500-5,800 | Chaparral, lower and upper montane coniferous forest/openings, usually granitic | Present in the Project Vicinity, including Cascade and Brush Creek quadrangles |

**Table 4.10-1. (continued)**

| Common Name/ Scientific Name | Status[1] | Flowering Period | Elevation Range (ft) | Habitat Requirements | Occurrence in Project Vicinity[2] |
|---|---|---|---|---|---|
| Northern Sierra daisy *Erigeron petrophilus* var. *sierrensis* | FW-T CNPS 4 | Jun-Oct | 900-5700 | Cismontane woodland, lower montane coniferous forest, upper montane coniferous forest, rocky soils | Potential to occur in the Project Boundary; present in the TNF |
| Ahart's sulfur flower *Eriogonum umbellatum* var. *ahartii* | FSS-P CNPS 1B | Jun-Sep | 1,300-3,300 | Serpentine soils | Present in the Project Vicinity, including Challenge, Cascade, and Clipper Mills quadrangles |
| Minute pocket moss *Fissidens pauperculus* | FSS-P CNPS 1B | --- | 0-Below 3,600 | Not well known | Present in the Project Vicinity, including Cascade, Brush Creek, and Forbestown quadrangles |
| Pursh's buckthorn *Frangula purshiana* ssp. *ultramafica* | FSS-P CNPS 1B | May-Jul | 2,700-6,350 | Chaparral, lower montane coniferous forest, meadows and seeps, upper montane coniferous forest, serpentine soils | Potential to occur in Project Boundary |
| Butte County fritillary *Fritillaria eastwoodiae* | FSS-T FSS-P CNPS 3 | Mar-Jun | 150-4,900 | Chaparral, cismontane woodland, lower montane coniferous forest, sometimes serpentine | Present in Project Vicinity, including Challenge, French Corral, Clipper Mills, North Bloomfield, Washington, Rackerby, Cascade, Brush Creek, Forbestown, and Nevada City quadrangles |
| Ahart's dwarf rush *Juncus leiospermus* var. *ahartii* | CNPS 1B | Mar-May | 100-750 | Valley and foothill grassland | Present in Project Vicinity, including the Loma Rica quadrangle |
| Dubious pea *Lathyrus sulphureus* var. *argillaceus* | CNPS 3 | Apr-May | 500-1,000 | Cismontane woodland, upper and lower montane coniferous forest | Present in the Project Vicinity, including Rough and Ready and Wolf quadrangles |
| Legenere *Legenere limosa* | CNPS 1B | Apr-Jun | 0-Below 2,900 | Vernal pools | Potential to occur in Project Boundary |
| Cantelow's lewisia *Lewisia cantelovii* | FSS-P FSS-T CNPS 1B | May-Oct | 1,000-4,500 | Broadleaf upland forest, chaparral, cismontane woodland, lower montane coniferous forest/mesic, granitic, sometimes serpentinite seeps | Present in the Project Vicinity including Pike, French Corral, Strawberry Valley, Alleghany, North Bloomfield, Washington, Goodyears Bar, Downieville, and Brush Creek quadrangles |
| Humboldt lily *Lilium humboldtii* ssp. *humboldtii* | FW-T FW-P CNPS 4 | May-Jul | 1500-3500 | Chaparral, cismontane woodland, lower montane coniferous forest, openings | Present in the Project Vicinity, including the Washington quadrangle |
| Quincy lupine *Lupinus dalesiae* | FSS-T FSS-P CNPS 4 | May-Aug | 30002,800-8000 | Chaparral, cismontane woodland, lower montane coniferous forest, upper montane coniferous forest | Present in the Project Vicinity, including La Port and Goodyears Bar quadrangles |
| Bog club-moss *Lycopodiella inundata* | CNPS 2 | Jun-Sept | 0-Below 3,300 | Bogs and fens, lower montane coniferous forest, marshes and swamps | Present in the Project Vicinity, including the North Bloomfield quadrangle |
| Elongate copper moss *Mielichhoferia elongata* | FSS-T CNPS 2 | --- | 1,600-4,300 | Vernally wet rock in cismontane woodland, (metamorphic rock, usually vernally mesic) | Present in the Project Vicinity, including Washington and Nevada City quadrangles |
| Shieldbract monkeyflower *Mimulus glaucescens* | FW-P CNPS 4 | Feb-Aug | 200-4,100 | Chaparral, cismontane woodland, lower montane coniferous forest, valley and foothill grassland and serpentine seeps, sometimes streambanks | Potential to occur in Project Boundary |
| Cut-leaved monkey flower *Mimulus lacinatus* | CNPS 4 | Apr-Jun | 1500-9000 | Chaparral, lower montane coniferous forest, upper montane coniferous forest, seeps in granite | Potential to occur in Project Boundary |

**Table 4.10-1. (continued)**

| Common Name/ Scientific Name | Status[1] | Flowering Period | Elevation Range (ft) | Habitat Requirements | Occurrence in Project Vicinity[2] |
|---|---|---|---|---|---|
| Follett's monardella *Monardella follettii* | FSS-T FSS-P CNPS 1B | Jun-Sep | 1,900-6,600 | Lower montane coniferous forest, rocky, serpentine | Present in the Project Vicinity, including the Grass Valley quadrangle |
| Aquatic lichen *Peltigera hydrothyrea [Hydrothyria venosa]* | FSS-T FSS-P | --- | 1,150-7,000 | Stones, boulders, and occasionally wood along streams and rivers, submerged at least part of the year | Potential to occur in Project Boundary; known to occur within 3 miles of the project area at about 3,400 feet. |
| Bacigalupi's yampah *Perideridia bacigalupi* | FW-P CNPS 4 | Jun-Aug | 1700-3500 | Chaparral, lower montane coniferous forest, serpentine | Potential to occur in Project Boundary; present in the TNF |
| Stebbins Phacelia *Phacelia stebbinsii* | FSS-T CNPS 1B | May-Jul | 2,000-6,600 | Cismontane woodland; lower montane coniferous forest; meadows and seeps | Potential to occur in Project Boundary |
| Cedar Crest popcorn flower *Plagiobothrys glyptocarpus* var. *modestus* | CNPS 3 | Apr-Jun | 150-2,850 | Cismontane woodland, valley and foothill grassland | Present in the Project Vicinity, including Oregon House and Grass Valley quadrangles |
| ~~Slender-leaved pondweed *Stuckenia filiformis [Potamogeton filiformis]*~~ | ~~FSW CNPS 2~~ | ~~May-Jul~~ | ~~950-7050~~ | ~~Marshes and swamps, lakes and ponds~~ | ~~Potential to occur in Project Boundary~~ |
| Green- flowered wintergreen *Pyrola chlorantha* | CNPS 1A | Jun-Jul | ±2,950 | Lower montane coniferous forest | Present in the Project Vicinity, including the Downieville quadrangle |
| White beaked-rush *Rhynchospora alba* | FSW-T CNPS 2 | Jul-Aug | 200-6700 | Meadows and seeps, marshes and swamps, wet places | Potential to occur in Project Boundary; present in the TNF |
| Brownish beaked-rush *Rhynchospora capitellata* | FW-P CNPS 2 | Jul-Aug | 1,500-6,600 | Upper and lower montane coniferous forest, meadows and seeps, marshes and swamps | Present in Project Vicinity, including Pike, Clipper Mills, Grass Valley, North Bloomfield, Cascade, Brush Creek, and Nevada City quadrangles |
| Tracy's blacksnakeroot *Sanicula tracyi* | CNPS 4 | Apr-Jun | 300-5,200 | Cismontane woodland, lower montane coniferous forest, openings in upper montane coniferous forest | Present in Project Vicinity, including the Clipper Mills quadrangle |
| Swaying bulrush *Schoenoplectus subterminalis [Scirpus subterminalis]* | FW-P CNPS 2 | Jun-Aug | 2,450-7,400 | Bogs and fens, marshes and swamps, montane lake margins | Potential to occur in Project Boundary |
| Marsh skullcap *Scutellaria galericulata* | CNPS 2 | Jun-Sep | Below 6,900 | Lower montane coniferous forest, meadows and seeps, marshes and swamps | Potential to occur in Project Boundary |
| Feather River stonecrop *Sedum albomarginatum* | FSS-P CNPS 1B | May-Jun | 850-6,400 | Chaparral, lower montane coniferous forest and serpentine soils | Potential to occur in Project Boundary |
| Lewis' groundsel *Senecio eurycephalus* var. *lewisrosei* | FSS-P CNPS 1B | Mar-Sep | 900-6,200 | Chaparral, cismontane woodland, lower montane coniferous forest | Potential to occur in Project Boundary |
| Peat moss *Sphagnum* spp. | FW-T | --- | --- | Fens, peatlands, and wet areas | Potential to occur in Project Boundary |
| Long-fruit jewelflower *Streptanthus longisiliquus* | FW-P CNPS 4 | Apr-Sep | 2,300-4,900 | Openings in cismontane woodland lower montane coniferous forest | Potential to occur in Project Boundary |
| ~~Tracy's sanicle *Sanicula tracyi*~~ | ~~CNPS 4~~ | ~~Apr-Jul~~ | ~~300-5,200~~ | ~~Cismontane woodland, lower montane coniferous forest, upper montane coniferous forest~~ | ~~Present in Project Vicinity, including the Clipper Mills quadrangle~~ |
| Slender-leaved pondweed *Stuckenia filiformis [Potamogeton filiformis]* | FW-T CNPS 2 | May-Jul | 950-7,050 | Marshes and swamps, lakes and ponds | Potential to occur in Project Boundary |

**Table 4.~~10~~-1. (continued)**

| Common Name/ Scientific Name | Status[1] | Flowering Period | Elevation Range (ft) | Habitat Requirements | Occurrence in Project Vicinity[2] |
|---|---|---|---|---|---|
| Cylindrical trichodon *Trichodon cylindricus* | FW-P CNPS 2 | --- | 150-6,600 | Broadleaf upland forest, meadows and seeps, upper montane coniferous forest/sandy, exposed soil, roadbanks | Present in the Project Vicinity, including the La Porte quadrangle |
| Lesser bladderwort *Utricularia minor* | FW-T CNPS 4 | Jul | 2,600-2,900 | Bogs and fens, marshes, swamps and calcium-rich water | Potential to occur in the Project Boundary |

[1] Sources: United States Department of Agriculture, Forest Service 2010 b,c,d.

[1] Special-status:
~~FE: Federal Endangered Species~~
~~FT: Federal Threatened Species~~
~~SE: California Endangered Species~~
SR: ~~California Rare Species~~state-listed rare
SC: state candidate for listing
FPE: federally proposed endangered
FPT: federally proposed threatened
~~ST: California Threatened Species~~
CNPS: California Native Plant Society listed species
1A: Species presumed extinct in California
1B: Species considered rare or endangered in California and elsewhere (no legal protection)
2: Species considered rare or endangered in California but more common elsewhere (no legal protection)
3: More information needed about this species
4: Limited distribution; watch list
FSS: United States Forest Service Sensitive Species (FSS-P: ~~-~~Plumas National Forest; FSS-T: ~~-~~Tahoe National Forest) (USDA-FS 2010b,c)
FW: United States Forest~~-~~ Service Watchlist Species (FW-P:~~-~~ Plumas National Forest; FW-T: ~~-~~Tahoe National Forest) (USDA-FS 2010b,d)

[2] Occurrence in Project Vicinity results based on a CNPS quadrangle search.

None of the available CNDDB reports are from surveys within the existing FERC Project Boundary.[3]

Additional information is needed to address the study goal is the specific location of special-status plants in relation to Project facilities, normal Project O&M activities, Project recreation, and any other Project-related activities that might affect special-status plants.

## 4.2 Incidental Observations

### 4.2.1 Noxious Weeds

Documentation of existing occurrences of noxious weeds in the Project Area was not available. Potential noxious weed occurrences are listed in Table 4.2-1 (USDA-NRCS 2009, Cal-IPC 2006). A total of 36 noxious weeds have the potential to occur within the Project Vicinity.

[3] The existing FERC Project Boundary is the area that Licensee uses for normal Project operations and maintenance, and is shown on Exhibits J, K, and G of the current license.

**Table 4.2.1-1. Noxious weeds and other invasive species of concern to the Forest Service potentially occurring in the Project Vicinity.**

| Common Name/ Scientific Name | CDFA Status[1] | Flowering Period | Elevation (ft) | Habitat |
|---|---|---|---|---|
| Russian knapweed *Acroptilon repens* [*Centaurea repens*] | B | May-Sept | Below 6,200 | Fields, roadsides, cultivated ground, disturbed areas |
| Barb goatgrass *Aegilops triuncialis* | B | May-Aug | Below 3,300 | Disturbed sites, cultivated fields, roadsides |
| Tree-of-heaven *Ailanthus altissima* | C | May-Jul | Below 6,100 | Disturbed areas, roadsides, and urban waste areas |
| Giant reed *Arundo donax* | B | Mar-Nov | Below 1,700 | Riparian areas, floodplains, and ditches |
| Cheatgrass *Bromus tectorum* | Not rated | May-June | Below 6,000 | Fields, roadsides, cultivated ground, disturbed areas |
| Plumeless thistle *Carduus acanthoides* | A | May-Aug | Below 4,300 | Roadsides, pastures, waste areas |
| Musk thistle *Carduus nutans* | A | Jun-Jul | 330-4,000 | Roadsides, pastures, waste areas |
| Italian thistle *Carduus pycnocephalus* | C | May-Jul | Below 3,300 | Roadsides, pastures, waste areas |
| Woolly distaff thistle *Carthamus lanatus* | B | July-Aug | Below 3,600 | Disturbed sites |
| Purple starthistle *Centaurea calcitrapa* | B | Jul-Oct | Below 3,300 | Disturbed areas |
| Diffuse knapweed *Centaurea diffusa* | A | Jun-Sep | Below 7,600 | Fields, roadsides |
| Spotted knapweed *Centaurea maculosa* | A | July-Aug | Below 8,500 | Open disturbed sites, grasslands, forested areas, roadsides |
| Maltese starthistle *Centaurea melitensis* | C | Apr-July | Below 7,200 | Open disturbed sites, grasslands, roadsides, waste places |
| Yellow starthistle *Centaurea solstitialis* | C | Jun-Dec | Below 4,300 | Pastures, roadsides, disturbed grassland or woodland |
| Rush skeletonweed *Chondrilla juncea* | A | May-Dec | Below 2,000 | Disturbed areas |
| Canada thistle *Cirisum arvense* | B | Jun-Sep | Below 5,900 | Disturbed areas |
| Bermudagrass *Cynodon dactylon* | C | Jun-Aug | Below 3,000 | Disturbed areas |
| Scotch broom *Cytisus scoparius* | C | Mar-Jun | Below 3,300 | Disturbed areas |
| Oblong spurge *Euphorbia oblongata* | B | Apr-Aug | Below 3,300 | Waste areas, disturbed sites, roadsides, fields |
| Japanese knotweed *Fallopia japonica* | B | Aug-Oct | Below 3,300 | Disturbed areas |
| Sakhalin knotweed, giant knotweed *Fallopia sachalinensis* | B | Jul-Oct | Below 1,650 | Disturbed areas |
| French broom *Genista monspessulana* | C | Mar-May | Below 1,600 | Disturbed areas |
| English Ivy *Hedera helix* | Not rated | Autumn | Below 3,300 | Disturbed forests, woodlands, and riparian areas |
| Hydrilla *Hydrilla verticillata* | A | Jun-Aug | Below 650 | Ditches, canals, ponds, reservoirs, lakes |
| Dyer's woad *Isatis tinctoria* | B | Apr-Jun | Below 3,300 | Roadsides, fields, disturbed sites |
| Lens-podded white-top *Lepidium draba* ssp. *chalepense* | B | Apr-Aug | Below 5,000 | Disturbed, generally saline soils, fields |
| Perennial pepperweed, tall white-top *Lepidium latifolium* | B | Apr-Aug | Below 6,300 | Beaches, tidal shores, saline soils, roadsides |
| Dalmation toadflax *Linaria genistifolia* ssp. *dalmatica* | A | May-Sep | Below 3,300 | Disturbed places, pastures, fields |

**Table 4.2.1-1. (continued)**

| | | | | |
|---|---|---|---|---|
| Purple loosestrife *Lythrum salicaria* | B | Jun-Sep | Below 5,300 | Seasonal wetlands, ditches, cultivated fields |
| Eurasian water milfoil *Myriophyllum spicatum* | C | July-Sep | Below 6,300 | Fresh to brackish water, slow-moving streams |
| Scotch thistle *Onopordum acanthium* | A | Jul-Sep | Below 5,300 | Disturbed areas |
| Himalayan blackberry *Rubus discolor* | Not rated | May-Sep | Below 5,300 | Disturbed moist sites, fields, roadsides, riparian areas |
| Spanishbroom *Spartium junceum* | Not rated | Mar-Jun | Below 2,000 | Open disturbed sites, grasslands, oak woodlands, riparian corridors, open forests |
| Medusahead *Taeniatherum caput-medusae* | C | Apr-Jul | Below 6,900 | Disturbed sites, grassland, openings in oak woodlands and chaparral |
| Gorse *Ulex europaeus* | B | Nov-Jul | Below 1,300 | Disturbed areas |

Sources: CDFA 2009; United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) 2009; California Invasive Plant Council (Cal-IPC) 2006; DiTamaso 2007; USDA Forest Service 2010 a,e.

[1] CDFA Status:

A = Eradication, containment, rejection, or other holding action at the state-county level. Quarantine interceptions to be rejected or treated at any point in the state.

B = Eradication, containment, control, or other holding action at the discretion of the commissioner. State endorsed holding action and eradication only when found in a nursery.

C = Action to retard spread outside of nurseries at the discretion of the commissioner; reject only when found in a crop seed for planting or at the discretion of the commissioner (CDFA 2009).

### 4.2.2 Forest Service Sensitive Fungi

Licensee will also record incidental observations of Forest Service Sensitive fungi species including branched collybia *(Collybia racemosa)*, large cudonia *(Cudonia monticola)*, and olive phaeocollybia *(Phaeocollybia olivacea)*[4]; these occurrences of Forest Service sensitive fungi will be included in reporting and mapping efforts for this study.

### 4.2.3 Tahoe and Plumas National Forests' ~~Service~~ Watchlist Plant Communities

Licensee will also record incidental observations of Tahoe and Plumas National Forests' ~~Forest Service~~ Watchlist plant communities including peatlands, fens, seeps, and springs will also be recorded; occurrence information will be included in Licensee's Wetlands Study 6.3.

# 5.0 Study Methods and Analysis

## 5.1 Study Area

The study area consists of the area within the existing FERC Project Boundary. This includes all Project facilities and features (e.g., dams, powerhouses and reservoirs) as well as Project recreation areas. The study area will also include a buffer of 100 feet extending upslope from the high-water mark of the Project reservoirs and from the FERC Project Boundary around Project recreation facilities.

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

[4] Licensee will make survey efforts to map the occurrence of olive phaeocollybia known to occur in Dark Day Campground within the Tahoe National Forest (TNF) at New Bullards Bar Reservoir; useful and relevant information will be provided by the Forest Service.

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

## 5.3 Methods

Study methods will consist of the following five steps: 1) gather data and prepare for field effort; 2) conduct field surveys; 3) prepare data and quality assure/quality control (QA/QC) data; 4) consult with Licensee's project operations staff; and 5) prepare report. Each step is described below.

### 5.3.1 Step 1 – Gather Data and Prepare for Field Efforts

Licensee will identify and map known occurrences of special-status plants within the study area, and prepare field maps for use by survey teams. The maps will include aerial imagery, Project features, and known special-status plant occurrences. Survey timing will be planned based on herbarium collection dates.

### 5.3.2 Step 2 – Conduct Field Surveys

Licensee's surveyors will conduct special-status plant surveys as outlined in the "Botanical Survey" section of the California Department of Fish and Game's (CDFG) *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (CDFG 2009)[5]. Surveys will be comprehensive over the entire study area using systematic field techniques to ensure thorough coverage, with additional efforts focused in habitats with a higher probability of supporting special-status plants (e.g., serpentine outcrops). Surveys will be floristic in nature, documenting all species observed; taxonomy and nomenclature will be based on *The Jepson Manual* (Hickman 1993).

When special-status plants are documented within the study area, the following information will be collected:

- Digital photographs, if needed, to describe the occurrence, its habitat, and any potential threats (at least ~~1~~ one digital photograph will be collected for each occurrence, with other photographs to document potential threats, or as needed)
- Estimated area (approximate length and width) covered by the special-status plant population and estimated number of individual plants in the population. If plant population is estimated to cover an area greater than 0.1 acre~~s~~, surveyors will delineate the occurrence boundary using a handheld GPS, collecting either polygon data, or sufficient point data that a realistic occurrence polygon can be constructed from the point data using GIS. For occurrences less than 0.1 acre in size, the location of the approximate center of the occurrence will be taken as point data using a handheld GPS unit
- Dominant and subdominant vegetation in the area
- Estimated distance to nearest Project facility, feature, or Project-related activity

[5] Replaces the CDFG's *Guidelines for Assessing the Effects of Proposed Project on Rare, Threatened, and Endangered Plants and Natural Communities* (CDFG 2000).

- Activities observed in the vicinity of the population that have a potential to adversely affect the population (e.g., recreational trails and uses)
- Estimated phenology and descriptions of reproductive state.

Licensee's noxious weed field surveys will be conducted in conjunction with special-status plants surveys when feasible, but are expected to require ~~separate~~ revisits ~~survey work as well,~~ to account for differences in plant phenology. For the purpose of the study, noxious weeds are defined as those plant species listed as "A," "B" or "C" by the California Department of Food and Agriculture (CDFA). Other invasive species to be recorded include species of concern to TNF and PNF that are not rated by the CDFA.

Weed data collection and reporting will be consistent with Section 2083 of the Forest Service Manual, Information and Reporting Guideline for Noxious Weeds (USDA –F–orest Service~~S~~ 1995). Two forms of noxious weed data will be collected and maintained, depending on the type and distribution of weeds located during survey efforts:

- Quantitative data: for discrete occurrences of weeds, data collected will include species, GPS-derived location, nearby sources of dispersal (e.g., roads), surrounding vegetation composition, and any nearby resource concerns (e.g., special-status plant occurrences), and an estimate of area covered~~,~~. If a noxious weed population is identified on the perimeter of the FERC Project Boundary the extent of the population extending beyond the boundary will be estimated. Levels of infestation will be reported by weed cover within the following classes: Low (<5% cover), Moderate (6-25% cover), and High (>25% cover). ~~within the following classes: <0.01 acre; <0.1 acre; <1 acre; <5 acres; >5 acres.~~

Qualitative data: for widespread weeds, or for those weeds for which detailed mapping is unlikely to remain accurate (e.g., annual grasses, which change distributions yearly), the Licensee will describe general distribution and extent within the study area.

### 5.3.3 Step 3 – Prepare Data and Quality Assure/Quality Control Data

Following field surveys, Licensee will develop GIS maps depicting special-status plant and incidental occurrences of noxious weeds, and Forest Service Sensitive Fungi, Project facilities, features, and specific Project-related impacts (e.g., dispersed use camping) and other related information collected during the study. Field data will then be subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of special-status plant occurrences.

### 5.3.4 Step 4 – Consult with Licensee's Project Operations Staff

Once the locations of special-status plants in the study area ~~is~~ are defined, Project operations staff will be consulted to identify Project O&M and Project-related activities that typically occur in the area of the special-status plant ~~–~~populations and incidental occurrences that have a potential to adversely affect the special-status species populations.

### 5.3.5 Step 5 – 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. Study results will be displayed in GIS maps that show ~~by~~ each special-status plant population ~~the~~ location in respect to project facilities and features. The GIS layer of ~~special status~~ of all mapped occurrences ~~plants~~ will be made available to the appropriate land management agencies. In addition, Licensee will develop a GIS layer for noxious weeds and make this available to the appropriate land management agencies.

For all special-status plant observations, Licensee will complete the appropriate CNDDB form and transmit the form to the CNDDB. For any special-status plant observations on National Forest System land, Licensee will provide a copy of the CNDDB forms or spreadsheets to the Forest Service at the same time as it is submitted to CNDDB.

## 6.0 Study-Specific Consultation

This study does not require any study-specific consultation.

## 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 September 16, 2011 and the study is not disputed by a mandatory conditioning agency~~October 4, 2011~~:

Planning (Step 1).....~~November~~ June 2011- February ~~2011~~2012
Collect Data (Step 2).....~~March 2011~~2012October 2011- ~~July~~ August ~~2011~~2012
QA/QC Review (Step 3) ..... August ~~2011~~2012
Operations Staff Consultation (Step 4) ..... August ~~2011~~2012
Study Report Preparation (Step 5) .....~~September~~ August~~2011~~2012- ~~October~~ September 2012

## 8.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is consistent with the goals, objectives, and methods outlined for most recent FERC hydroelectric relicensing efforts in California, and uses standard botanical survey methods as defined by the CDFG.

## 9.0 Level of Effort and Cost

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

# 10.0 References Cited

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Study 6.1

# RIPARIAN HABITAT UPSTREAM OF ENGLEBRIGHT RESERVOIR

February 11, 2011

## 1.0 Project Nexus and Issue

Yuba County Water Agency's (YCWA or Licensee) continued operation and maintenance (O&M) of the Yuba River Development Project (Project) may have the potential to affect riparian habitat.

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

The following was provided to Licensee by the United States Department of Agriculture Forest Service (Forest Service) as a description of the Forest Service's management goals for riparian habitat on National Forest System (NFS) land as identified in the National Forest Management Act (NFMA, public Law 94-588 1976) and the Tahoe National Forest TNF) Land and Resource Management Plan (TNF LRMP) (USDA Forest Service 1990), as amended by the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001~~2001a and 2001b~~) and the Supplemental Sierra Nevada Forest Plan Amendment (USDA Forest Service 2004a and 2004b):

- Plant Community Diversity/Special Habitats/Connectivity: Manage riparian plant communities to maintain and improve the species composition and structural diversity. Manage riparian plant communities to maintain and/or improve spatial and temporal connectivity for native riparian plant species within and between watersheds to provide physically, chemically and biologically unobstructed movement for their survival, migration and reproduction.

- Streamflow Patterns/Sediment Regimes/Stream and Shoreline Riparian Vegetation: Manage stream flows to maintain and /or improve in-stream flows so they are sufficient to sustain desired conditions of riparian plant communities. ~~–~~Manage streambanks and shorelines to minimize erosion and sustain desired riparian habitats.

## 3.0 Study Goals and Objectives

The goal~~s~~ of this study is~~are: 1)~~ to assess the condition of riparian habitats within river reaches upstream of the United States Army Corps of Engineer's (USACE) Englebright Reservoir potentially affected by continued Project O&M.

The objective of this study is to gather the data and information necessary to meet the study goals.

# 4.0 Existing Information and Need for Additional Information

YCWA's Pre-Application Document contained information about the riparian vegetation mapped in the area of the Project, including CalVeg maps and National Wetland Inventory (NWI) maps on a 1:24,000 scale, shown with United States Geological Survey (USGS) topographic features and Project facilities. Section 7.6 of the Pre-Application Document includes a table of NWI palustrine and riverine wetland types and acres within the Project Area[1] and the Federal Energy Regulatory Commission (FERC) Project Boundary.[2]

Based on NWI maps (1987), there are approximately 40,417 feet and 125 acres of riverine wetlands within the Project Area, with approximately 8,044 feet and 54 acres within the FERC Project Boundary. Remaining NWI classified wetland habitats in the Project Area include approximately 63,926 feet and 13 acres of palustrine wetlands and approximately 4,635 acres of reservoir open water.

NWI riparian wetlands have been classified using aerial imagery but no ground-mapping data is known to exist to support this inventory. In addition, no known site-specific assessments of riparian habitats or habitat condition within the FERC Project Boundary are known to exist. To achieve the study goals, additional information is needed.

# 5.0 Study Methods and Analysis

## 5.1 Study Area

The study area includes: 1) the Middle Yuba River from Our House Diversion Dam Impoundment to the confluence with the North Yuba River, 2) Oregon Creek from the Log Cabin Diversion Dam Impoundment to the confluence with the Middle Yuba River, 3) the North Yuba River from New Bullards Bar Dam Reservoir to the confluence with the Middle Yuba River, and 4) and the portion of the Yuba River from the confluence of the North and Middle Yuba rivers to just upstream of the USACE 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:

[1] For the purposes of this document, the Project Area is defined as the area within the Federal Energy Regulatory Commission (FERC) existing Project Boundary and the land immediately surrounding the FERC Project Boundary (i.e., within about 0.25 mile of the FERC Project Boundary) and includes Project-affected reaches between Project facilities and downstream to the next major water controlling feature or structure.

[2] The FERC Project Boundary is the area that Licensee uses for normal Project operations and maintenance, and is shown on Exhibits J, K, and G of the current license.

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

## 5.3 Methods

The study includes five steps: 1) site selection 2) gather data and prepare for field effort; 3) conduct field surveys; 4) prepare data and quality assure/quality control (QA/QC) data; and 5) prepare report. Each step is described below.

### 5.3.1 Step 1 – Site Selection

~~To the extent practical,~~ Licensee will co-locate study sites to the extent possible with Licensee's ~~Instream Flow~~ Study 1.1 Morphology Upstream of Englebright Reservoir Study sites. Six study sites have currently been proposed. At five of the six sites, three riparian vegetation transects will be performed along transects co-located with the Channel Morphology Study; at the site above Our House Dam on the Middle Yuba River, one riparian vegetation transect will be performed, co-located with the ~~and~~ Channel Morphology Study. A total of sixteen vegetation transects will be performed.

Channel Morphology ~~PHABSIM~~ study sites ~~(transect or transect cluster locations)~~ are selected within a reach to represent the range of channel and habitat types in the reach (Bovee 1982). The characteristic feature of a ~~PHABSIM~~ study reach is homogeneity of the channel structure and flow regime. The sites chosen will represent those sites most likely to exhibit effects of project features and operations on channel morphology and habitat features.

Based on historic and habitat mapping information, in the Middle and North Yuba rivers and in the Yuba River upstream of USACE's Englebright Reservoir, channel characteristics are primarily controlled by bedrock and boulders, rather than fluvial processes. In other words, these channels are not usually "self-formed" and boulders and bedrock control lateral and vertical stability. Bedrock channels are generally insensitive to short-term changes in sediment supply or discharge. Only a persistent decrease in discharge and/or an increase in sediment supply sufficient to convert the channel to an alluvial morphology would significantly alter bedrock channels (Montgomery and Buffington 1993). However, there may be localized changes to morphology and substrate distribution that may affect ecology.

Characteristics of the areas where Channel Morphology~~riparian habitat~~ sites will be placed are gradients less than 2 percent, accumulations of gravel and finer material in channel and on margins, and floodplain and/or terrace development. Based on habitat mapping information, the study will include five study sites to be located within each reach ~~The study includes five locations~~ (Table 5.3-1).

**Table 5.3-1. Potential location and character of riparian habitat study sites to be co-located with Study 1.1 Channel Morphology.**

| Stream | Potential Location | Character |
|---|---|---|
| Middle Yuba River | Below Oregon Creek in the vicinity of Freemans Crossing (RM 3.5 -4.5) | Moderately and unconfined channel, ~1% gradient, alluvial and depositional. |
| | Above Oregon Creek (RM 4.5 – 5.5) | Steeper (>1% gradient), confined, more transport-dominated than near Freemans's Crossing, though some lateral cobble/gravel bar development. |
| | Above Our-House Dam | Low gradient (1.7% map gradient), depositional. |
| Oregon Creek | Celestial Valley (RM 1.5 – 2.5) | Confined 1.6% gradient, planar bedform, gravel-sized material in channel and on margins. |
| North Yuba River | Below New Bullards Bar Dam. | Reach has very little accessibility due to vertical cliffs, and dominance of bedrock and boulders within channel. Large, immobile substrate, lateral and vertical controls by bedrock limits responsiveness to changes in inputs of sediment and to changes in hydrology. |
| Yuba River | Below New Colgate Powerhouse | Confined, less than 1%, cobble and boulder-dominated bed with very deep pools immediately below the Powerhouse, but increasing alluvial deposition as move downstream. |

### 5.3.2 Step 2 – Collect and Review Existing Data and Information

Existing data, including Geographic Information System (GIS) data, historical information, reports, maps, and aerial photography relevant to riparian vegetation will be collected and reviewed where available for river reaches. These sources are expected to provide documentation on geology, topography, soils, riparian vegetation coverage and type, invasive species, and land-use (i.e. mining, timber management, recreation, road development, fires, grazing, and water diversions). Information regarding riparian vegetation and physical processes on western slope Sierra Nevada streams or other pertinent riparian literature from other geographic regions will also be reviewed. Pertinent information will be used for comparison and interpretive purposes when evaluating the streams and rivers in the study area.

### 5.3.3 Step 3 – Condition Assessment

Surveyors will collect quantitative data along vegetation transects. Vegetation transects will extend from the water's edge at low flow, to hill slope (including bars if present); at the Oregon Creek study site, where the channel is unconfined, the vegetation transect will end at calculated floodprone width. For the purpose of the study, riparian vegetation is defined as wetland indicator species as identified by the *National List of Plant Species that Occur in Wetlands: California (Region 0)*, (Reed 1988).~~conduct a condition assessment at each site using the protocol *Riparian Area Management, A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas* (Prichard *et al.* 1998). Observations of representative conditions and noteworthy atypical conditions (*e.g.*, channel encroachment or site-specific erosion) will be documented by geo-referenced photographs. Recorded site information will include: 1) hydrologic attributes and processes including observations for historical and existing flow levels, connection to floodplain, sinuosity, width/depth ratio, and gradient 2) vegetative attributes including dominant and sub-dominant vegetative species; vertical community distribution; horizontal community stratification; evidence of periodic recruitment and vigor; presence of large woody debris; and dominant and sub-dominant species for known association~~

~~with moist soil conditions[3] and capability for maintaining bank stability against the erosive forces of moving water 3) erosion and/or deposition attributes including floodplain and channel characteristics; vegetative colonization of point bars; vertical stability; and sediment supply.~~

Information collected along each transect will include two types of plots: 1) herbaceous vegetation (1 meter square plots), and 2) woody vegetation (trees and shrubs) (5 by 2 meter plots). Plots will be nested, with herbaceous and other cover plots occurring within the woody vegetation plots. More than one herbaceous and other cover plot may be located within a woody plot. Both the woody and herbaceous cover plots will be located perpendicular to transects located on the downstream side.

At a minimum, each transect will have at least two nested plots: one woody plot on each side of the stream at the start of vegetation, and within each woody plot, two herbaceous plots located side by side. Additional fluvial features (i.e. floodplains and terraces) that are at least 2 meters wide and are intersected by a vegetative transect will have a minimum of one nested plot. The following information will be collected in the plots:

Herbaceous vegetation:

- Dominant species cover in percent
- Total canopy cover
- Layer canopy cover (generally stratified by herbaceous and other, shrub, and tree layers)
- List all species present in each plot and provide an indication of whether they are native and/or special-status
- Other cover data (i.e. large woody debris or boulders)

Woody vegetation:

- Canopy coverage class in percent
- Stem count per individual or species class
- Tree diameter in DBH
- Dominant species relative decadence in percent
- Dominant species coverage in percent
- List all tree and shrub species present and provide an indication of whether they are native and/or special-status[4]
- Other cover data (i.e. large woody debris or boulders)

General riparian site information to be collected includes:

- Channel and bank substrate along transects
- Evidence of channel encroachment or bank instability (including any excessive erosion or deposition)

[3] ~~Dominant and subdominant vegetation, soil conditions, and hydrology will be recorded in the field using methods described in the United States Army Corps of Engineers (USACE) Wetland Delineation Manual (USACE 1987, 2008).~~

[4] For all special-status species observations, Licensee will complete the appropriate CNDDB form and transmit the form to the CNDDB. Licensee will provide a copy of the CNDDB form to the Forest Service if the observation occurs on NFS land.

- The presence of large woody debris within the riparian corridor
- Evidence of recreational and other land use activities
- Evidence of unusual stress or mortality on riparian plant community
- Evidence of riparian vegetative connectivity (or lack of)
- Hydrologic connectivity (or lack of)
- Biotic structure, including vertical and horizontal complexity

In addition, Licensee will collect:

- Herbarium specimen for all bryophyte species encountered in the plots (or otherwise observed at the site) and submit the specimen ~~data for incidental observations of special-status species. For all special-status species observations, Licensee will complete the appropriate CNDDB form and transmit the form to the CNDDB. Licensee will provide a copy of the CNDDB form~~ to the Forest Service.
- Establish photo points at each site.
- Add the presence of riparian vegetation to cross-sectional profiles to indicate where the vegetation ~~if the observation~~ occurs relative to ~~bankful~~bankfull and flood prone widths.
- Provide rooting depth (as indicated by available literature search - no site-specific measurements) of the dominant riparian species present in a tech memo. Historical photograph analysis of riparian study sites~~on NFS land~~.

### 5.3.4 Step 4 – Prepare Data and Quality Assure/Quality Control Data

Following field surveys, Licensee will develop GIS maps depicting existing riparian habitat and other related information collected during the study. Field data will then be subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of wetland and riparian sites found.

### 5.3.5 Step 5 – 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 include field data to support riparian condition assessment and riparian habitat maps.

## 6.0 Study-Specific Consultation

The study includes one study-specific consultation:

- Licensee will consult with interested and available Relicensing Participants regarding the number and location of the riparian habitat assessment sites (Step 1).

## 7.0 Schedule

Licensee anticipates the schedule to complete the study as follows assuming ~~the Pre-Application Document (PAD) is filed on November 1, 2010, and~~ FERC issues its Study Determination by September 16, 2011 and the study is not disputed by a mandatory conditioning agency~~October 4, 2011~~:

Site Selection (Step 1)..... February~~November~~ 2011 - March 201~~12~~
Collect and Review Existing Data and Information (Step 2) ..... April 201~~12~~- May 201~~12~~
Condition Assessment (Step 3)..... June - July 201~~12~~
Prepare and QA/QC Data (Step 4) ..... ~~August~~July 201~~12~~
Study Report Preparation (Step 5)..... ~~September~~ August 201~~12~~- ~~October~~ September 2012

## 8.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study provides an assessment of existing riparian vegetation and is consistent with the goals, objectives, and methods outlined for most recent FERC hydroelectric relicensing efforts in California. The proposed methodologies use standard assessment methods developed and used by federal land management agency personnel.

## 9.0 Level of Effort and Cost

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

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Buffington, J.M. and D.R. Montgomery. 1999. A procedure for classifying textural facies in gravel-bed rivers. Water Resources Research. Vol35, No. 6, pp 1903-1914.

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~~Prichard, D., J. Anderson, C. Correll, J. Fogg, K. Gebhardt, R. Krapf, S. Leonard, B. Mitchell, and J. Staats. 1998. Riparian area management: a user guide to assessing proper functioning condition and the supporting science for lotic areas. Technical Reference 1737-15. Bureau of Land Management, BLM/RS/ST-98/001+1737, Service Center, Denver, CO. 136 pp.~~

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Study 12.1

# HISTORIC PROPERTIES

February 11, 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 historic properties.[1]

Licensee will treat all information regarding the specific locations of cultural resource sites[2] ~~,~~[3] which include historic properties, as "Privileged and Confidential." Without prior approval from the Federal Energy Regulatory Commission (FERC), the Global Positioning System (GPS) coordinates and maps showing the locations of such resources will not be made available to any Relicensing Participant other than FERC, State Historic Preservation Officer (SHPO), United States Department of Agriculture Forest Service (Forest Service) for sites on National Forest System (NFS) land, United States Department of Interior (USDOI) Bureau of Land Management (BLM) for sites on public land administered by BLM, and participating federally-recognized Tribes.

## 2.0 Resource Management Goals of Agencies with Jurisdiction Over the Resource to be Studied[4]

Under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, federal agencies must take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. As provided in 18 CFR § 5.5(e), Licensee in its Notice of Intent to File an Application for New License intends to request that the FERC, the lead federal agency for the licensing, designate Licensee as FERC's non-federal representative for purposes of

[1] As defined under 36 CFR 800.16(l), historic properties are prehistoric or historic sites, buildings, structures, objects, districts, or locations of traditional use or beliefs that are included in, or eligible for inclusion in, the National Register of Historic Places (NRHP).[1] Historic properties are identified through a process of evaluation against specific criteria. For most cultural resources evaluated for listing on the NRHP, these criteria are found at 36 CFR 60.4.

[2] This study plan utilizes the term cultural sites to identify any prehistoric or historic district, site, building, structure, object, or Traditional Cultural Properties, regardless of its inclusion in or eligibility for inclusion in the National Register of Historic Places (NRHP).

[3] ~~This study plan utilizes the term cultural sites to identify any prehistoric or historic district, site, building, structure, object, or Traditional Cultural Properties, regardless of its inclusion in or eligibility for inclusion in the National Register of Historic Places (NRHP).~~

[4] ~~Under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, federal agencies must take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. As provided in 18 CFR § 5.5(e), Licensee in its Notice of Intent to File an Application for New License requested that the FERC, the lead federal agency for the licensing, designate Licensee as FERC's non-federal representative for purposes of initiating consultation under Section 106 of the NHPA and the implementing regulations at 36 CFR § 800.2(c)(4).~~

initiating consultation under Section 106 of the NHPA and the implementing regulations at 36 CFR § 800.2(c)(4).

[Relicensing Participants - This remainder of 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 Licensee 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 by an agency or agencies 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 Study Goals and Objectives

The goal of the study is to assist FERC in meeting its compliance requirements under Section 106 of the NHPA, as amended, by determining if licensing of the Project will have an adverse effect on historic properties.

The objective of this study is to identify and assess Project effects on historic properties and potential historic properties that may be affected by Project O&M, and determining which of these resources requires NRHP-eligibility evaluations.

# 4.0 Existing Information and Need for Additional Information

Licensee's Preliminary Information Package (YCWA 2009) described existing, relevant, and reasonably available information regarding cultural resources. This information is summarized below.

## 4.1 Background Research

To gather existing, relevant, and reasonably available information regarding cultural resources in the project vicinity, records searches were performed at State of California repositories in May and June 2009 at the North Central Information Center (NCIC) of the California Historical Resources Information System (CHRIS) at California State University, Sacramento (CSU, Sacramento) and the Northeast Information Center (NEIC) at California State University, Chico (CSU, Chico).

The review of 96 previous cultural resources investigations and archival information indicates that lands in the FERC Project Boundary and within 0.25 mile of that boundary have been the subject of cultural resource investigations for over 40 years. Licensee estimates that the FERC

Project Boundary contains 7,800 acres, of which approximately 4,700 acres (approximately 60%) are within the normal maximum water surface elevation of New Bullards Bar Reservoir. Based on existing and reasonably available information, all but about 2,200 acres of the area within the FERC Project Boundary were previously surveyed for cultural resources. However, most of those studies are more than 10 years old and/or do not meet current professional standards for fieldwork. Table 4.1-1 lists all of the previous cultural resources investigations identified within the Project Data Gathering Area (e.g., the FERC Project Boundary and 0.25-mile study area surrounding the FERC Project Boundary).

**Table 4.1-1. Previous cultural resources investigations within the Project Data Gathering Area.**

| Author | Date | Title | NCIC/NEIC Report No. | County | Quadrangle |
|---|---|---|---|---|---|
| Amesbury, Tom | 1998 | Milk Ranch Timber Harvest Plan | NCIC-8412 | Yuba | Challenge |
| Andrews, Steven | 2001 | YWCA Fire Salvage Timber Harvest Plan | NCIC-639 | Yuba | Challenge |
| Banka, William | 2001 | Pendola Ranch Timber Harvest Plan | NCIC-8297 | Yuba | Camptonville |
| Beeson, Allison | 1998 | Middlebrook Timber Harvest Plan | NCIC-789 | Yuba | French Corral |
| Bevill, Russell and Heath Browning | 2006 | Strawberry Etals Heritage Resource Inventory, Feather River Ranger District, Plumas National Forest, Plumas, Sierra, and Yuba Counties, California | NCIC-7537 | Yuba | Strawberry Valley |
| Bjorkman, Philip | 1992 | McClellan Middle Fork Timber Harvest Plan | NCIC-7598 | Nevada, Yuba | Camptonville |
| Boardman, Stan | 1997 | Chute Ravine Timber Harvest Plan | NCIC-7859 | Yuba | Challenge, French Corral |
| Boudreauz, Daniel | 2006 | An Archaeological Survey Report for the Bullard Timber Harvesting Plan, Yuba County, California | NCIC-8591 | Yuba | Challenge |
| Bystry, Carl | 1994 | Henry Timber Harvest Plan | NCIC-873 | Yuba | Challenge |
| Carr, Rick | 2004 | An Archaeological Survey Report for the Amendment Area on Section 27 Timber Harvesting Plan, Yuba County, California | NCIC-7146 | Yuba | Challenge |
| Cifelli, Chris | 1977 | Burnt Bridge Trail | NCIC-881 | Yuba | Challenge |
| Compas, Lynn | 2004 | Cultural Resource Inventory for Pacific Gas and Electric's Proposed Colgate-Smartville #1 60 kV Transmission System Replacement Project, Yuba County, California | NCIC-7099 | Yuba | French Corral, Oregon House, Smartville |
| Compas, Lynn and April Van Wyke | 2007 | Cultural Resources Inventory and National Register of Historic Places Evaluation of the Narrows Substation Transformer Bank Installation, Narrows Hydroelectric System (FERC No. 1403), Nevada County, California | NCIC-8665 | Nevada | Smartville |
| Davidson, Dario | 1995 | Lowman Timber Harvest Plan | NEIC-3769 | Sierra, Yuba | Pike and Camptonville |
| Davidson, Dario | 1995 | Lowman Timber Harvest Plan | NCIC-8450 | Yuba | Camptonville |
| Davidson, Dario | 1999 | Bope Timber Harvest Plan | NEIC-2733 | Sierra | Pike and Camptonville |
| Davidson, Dario | 2002 | Tanoak Timber Harvest Plan | NCIC-8456 | Tuba | Strawberry Valley |
| Davidson, Dario | 2002 | 59er Timber Harvest Plan | NCIC-8318 | Yuba | Camptonville |
| Day, Donna | 1983 | Archaeological Reconnaissance Report - Short Form - Milk Ranch Mining Claim | NCIC-8441 | Yuba | Challenge |
| Day, Donna | 1984 | Archaeological Reconnaissance of the Race Track Mining Claim | NCIC-8388 | Yuba | Strawberry Valley |
| Day, Donna | 1985 | Cultural Resources Inventory Report for the Oregon Hill Timber Compartment | NCIC-8468 | Yuba | Challenge |
| Day, Hollis | 1997 | Bean Ranch Timber Harvest Plan | NCIC-8566 | Yuba | Clipper Mills |
| Day, Hollis | 1998 | New Bullards Bar Timber Harvest Plan | NCIC-827 | Yuba | Camptonville |
| Deal, Krista | 1980 | Archaeological Reconnaissance Report, Elbow Timber Sale | NCIC-5608 | Yuba | Camptonville |
| Dwyer, Erin and Elena Nilsson | 2004 | Heritage Resource Inventory of the Slapjack DFPZ, Plumas National Forest, California | NCIC-9297 | Yuba | Challenge, Clipper Mills, Strawberry Valley |
| Ferrier, Douglas | 1995 | Landsburg/Kerr Timber Harvest Plan | NEIC-4865 | Sierra | Camptonville |

**Table 4.1-1. (continued)**

| Author | Date | Title | NCIC/NEIC Report No. | County | Quadrangle |
|---|---|---|---|---|---|
| Fogerty, J. | 2002 | Heritage Resources Inventory for the Lower Slate Defensible Fuel Profile Zone | NCIC-8406 | Yuba | Strawberry Valley |
| Frey, Richard | 1991 | Greenville Timber Harvest Plan | NCIC-876 | Yuba | Challenge |
| Furlong, Steven | 2005 | An Archaeological Survey Report for the Steber Timber Harvesting Plan, Nevada County, California | NCIC-6653 | Yuba | Challenge |
| Furlong, Steve | 2007 | An Archaeological Survey Report for the Thompson Timber Harvesting Plan, Yuba County, California | NCIC-8733 | Yuba | Challenge |
| Gillett, Lucky | 1994 | Ruth Timber Harvest Plan | NCIC-921 | Yuba | French Corral |
| Gillett, Lucky | 1994 | Slapjack Timber Harvest Plan | NCIC-8562 | Yuba | Challenge |
| Gillett, Lucky | 1995 | Soroptomist Timber Harvest Plan | NCIC-8458 | Yuba | Camptonville, Challenge |
| Gillett, Lucky | 2000 | Vierra II Timber Harvest Plan | NCIC-7882 | Yuba | Challenge |
| Gillett, Lucky | 2000 | Celestial Valley Ditch Timber Harvest Plan | NCIC-8308 | Yuba | Camptonville |
| O'Halloran, Molly | 1992 | Cultural Resource Inventory of the Oregon Insect Young Growth Special Salvage Timber Sale, Sierra County, Downieville Ranger District, Tahoe National Forest, Report Number 05-17-1005 | NEIC-1388 | Sierra, Yuba | Goodyear's Bar, Camptonville, Pike, Strawberry Valley |
| Helm, Wayne | 1999 | Little Oregon Creek/Fountain House Emergency Timber Salvage | NCIC-7096 | Yuba | Challenge |
| Henrie, LeAnn | 1995 | Cultural Resource Inventory for the Bullards Bar Underburn, Yuba County, Downieville Ranger District, Tahoe National Forest | NCIC-7632 | Yuba | Challenge |
| Humphreys, Stephen | 1967 | The Archaeology of the New Bullard's Bar Reservoir, Yuba County, California | NCIC-517 | Yuba | Camptonville |
| Jensen, Erik | 2003 | An Archaeological Survey Report for the Section 27 Timber Harvesting Plan, Yuba County, California | NCIC-7145 | Yuba | Challenge |
| Jensen, Erik | 2006 | An Archaeological Survey Report for the Section 28 CHY 80 Amendment, Yuba, California | NCIC-6928 | Yuba | Challenge |
| Johnson, James | 1992 | Burnt Ridge Timber Harvest Plan | NCIC-7888 | Yuba | Challenge |
| Johnson, James | 1994 | Hauck/Dunston Timber Harvest Plan | NCIC-8555 | Yuba | Challenge |
| Johnson, James | 1995 | Paredes Timber Harvest Plan | NCIC-8575 | Yuba | Camptonville, Challenge |
| Johnson, James | 1999 | 4-H Camp Timber Harvest Plan | NCIC-8551 | Yuba | Challenge |
| Johnson, Jerald and Dorothea Theodoratus; Storm, Donald | 1978; 1974 | Cultural Resources of the Marysville Lake, California Project (Parks Bar Site), Yuba and Nevada Counties, California; An Archaeological Site Survey of Selected Portions of the Proposed Marysville Dam Project, Yuba River, California | NCIC-48 | Yuba, Nevada | French Corral, Oregon House, Smartville |
| Jones, Terry | 1982 | The North Yuba Survey: A Prehistoric Archaeological Survey of 14,000 acres in the Northern Sierra Nevada; also Archaeological Survey of the Hawkfly and the North Yuba Timber Compartments and the Pride Timber Sale | NCIC-804 | Yuba, Sierra | Camptonville, Challenge, Clipper Mills, Strawberry Valley |
| Jones and Stokes | 2003 | Cultural Resources Inventory and Evaluation Report for the Yuba-Feather Supplemental Flood Control Project, Yuba County, California | NCIC-6014 | Yuba | Challenge |
| Keenan, Kelly | 2001 | UC Field Station Vegetation Management Plan | NCIC-2756 | Yuba | Oregon House, Smartville |
| Keye, William | 1993 | Toll House Timber Harvest Plan | NCIC-8311 | Yuba | Camptonville |
| Kostick, Greg | 1996 | Vierra Timber Harvest Plan | NCIC-7097 | Yuba | Challenge |
| Kostick, Greg | 2000 | Hewton Timber Harvest Plan | NCIC-7630 | Yuba | Challenge |
| Kostick, Greg | 2000 | Patterson Timber Harvest Plan | NCIC-7636 | Yuba | Challenge |
| Leach-Palm, Laura et al. | 2008 | Cultural Resources Inventory of Caltrans District 3 Rural Conventional Highways in Butte, Colusa, El Dorado, Glenn, Nevada, Placer, Sacramento, Sierra, Sutter, Yolo, and Yuba Counties | NCIC-9326 | Yuba, Nevada, Sierra | Camptonville |
| Leonhard, Scott | 1996 | Celestial Valley Timber Harvest Plan | NCIC-8320 | Yuba | Camptonville |
| Leonhard, Scott | 1997 | Bullards Bar Timber Harvest Plan | NCIC-650 | Yuba | Challenge, French Corral |
| Leonhard, Scott | 1998 | Pendola Timber Harvest Plan | NCIC-7093 | Yuba | Challenge |
| Leonhard, Scott | 2001 | Shappert Timber Harvest Plan | NCIC-8335 | Yuba | Camptonville |
| Levy, David | 1992 | Lacey-Kelly Timber Harvest Plan | NCIC-841 | Yuba | Challenge |

**Table 4.1-1. (continued)**

| Author | Date | Title | NCIC/NEIC Report No. | County | Quadrangle |
|---|---|---|---|---|---|
| Long, Kelly | 2005 | An Archaeological Survey Report for the Fuel Reduction on Private Lands in the Forest Service Slapjack DFPZ - Middlebrook, A Proposition 40 Project, Yuba County, California | NCIC-6973 | Yuba | French Corral |
| Maniery, James and Mary Maniery | 1997 | Cultural Resources Inventory of the Soper-Wheeler Land Exchange, Plumas National Forest, California | NCIC-642 | Yuba | Challenge, Clipper Mills, French Corral, Strawberry Valley |
| McCall, Dan | 2001 | Whitehead Timber Harvest Plan | NCIC-7858 | Yuba | Challenge, Clipper Mills |
| McKillop, Ryan | 1998 | Empire Creek Timber Harvest Plan | NCIC-7112 | Yuba | Clipper Mills |
| McMorris, Christopher | 2004 | Caltrans Historic Bridges Inventory Update: Metal Truss, Movable, and Steel Arch Bridges | NCIC-6675 | Yuba | Camptonville |
| Meals, Hank | 1979 | Camptonville Station Parking Lot Expansion | NCIC-8302 | Yuba | Camptonville |
| Newcomb, Alan | 1996 | Mumm Timber Harvest Plan | NCIC-834 | Yuba | Camptonville |
| Newcomb, Alan | 1997 | Robert Mumm Timber Harvest Plan | NCIC-2038 | Yuba | Camptonville |
| Origer, Thomas | 1985 | A Report on the Archaeological Reconnaissance of Pacific Gas and Electric Company's Camptonville Timber Sale Project, Yuba County, California | NCIC-456 | Yuba | Camptonville |
| Peak, Melinda | 1988 | Cultural Resources Assessment of the Colgate Tunnel Timber Sale Area, Yuba County, California | NCIC-8233 | Yuba | Challenge, French Corral |
| Rieger, Larry | 1992 | Browning Timber Harvest Plan | NCIC-651 | Yuba | Camptonville |
| Rieger, Larry | 1994 | Colgate-Challenge T/L Timber Harvest Plan | NCIC-8558 | Yuba | French Corral |
| Rogers, Terry | 1998 | Ingersoll-Dobbins Timber Harvest Plan | NCIC-7852 | Yuba | French Corral |
| Rogers, Terry | 1999 | Grizzly Gulch Timber Harvest Plan | NEIC-2727 | Sierra | Camptonville |
| Smith , Douglas | 1997 | Pendola Ranch Timber Harvest Plan - Additional Harvest Acres | NCIC-1129 | Yuba | Camptonville |
| Smith , Douglas | 1999 | Pendola Ranch Timber Harvest Plan - Additional Harvest Acres | NCIC-1130 | Yuba | Camptonville |
| Stevens, Dennis | 1995 | Cultural Resource Inventory of the Bullards Bar Water System Replacement, Yuba County, Downieville Ranger District, Tahoe National Forest, Report Number 05-17-1145 | NCIC-7646 | Yuba | Challenge |
| Stevens, Dennis | 1993 | Cultural Resources Inventory of the Oregon Creek Analysis Area, Yuba and Sierra Counties, Downieville Ranger District, Tahoe National Forest | NCIC-8446 | Yuba | Camptonville |
| Stevens, Dennis | 1994 | Cultural Resources Inventory of the Oregon Creek Analysis Area, Yuba and Sierra Counties, Downieville Ranger District, Tahoe National Forest (Addendum 1) | NCIC-8447 | Yuba | Camptonville |
| Stevens, Dennis | 1997 | Jaybird Timber Sale | NCIC-8403 | Yuba | Camptonville, Strawberry Valley |
| Stevens, Dennis | 1997 | Schoolhouse, Dark Day and Hornswoggle Campgrounds Rebuild Archaeological Report | NCIC-8439 | Yuba | Camptonville |
| Stevens, Dennis | 1997 | Moran Road Turnaround and Dark Day Parking Lot Expansion Archaeological Report | NCIC-8459 | Yuba | Camptonville, Challenge |
| Stevens, Dennis | 1982 | Mosquito Timber Sale Archaeological Reconnaissance Report | NCIC-8460 | Yuba | Camptonville, Challenge |
| Stevens, Dennis | 1988 | Skyline Compartment Timber Sale | NCIC-8457 | Yuba | Camptonville, Challenge |
| Storm, Donald | 1980 | Cultural Resource Investigation of the Ingersoll Subdivision Tracts 200, 222, and 224, near Dobbins, Yuba County, California | NCIC-596 | Yuba | French Corral |
| Violett, Paul | 1992 | Gellerman Timber Harvest Plan | NCIC-8559 | Yuba | Challenge, French Corral |
| Walden, Peter | 2000 | Burnett Timber Harvest Plan | NCIC-8552 | Yuba | Challenge |
| Wayland, Brian | 1999 | Summit Hill Ranch Timber Harvest Plan | NCIC-7640 | Yuba | Challenge |
| Werner, Roger and Jay Flaherty | 1981 | Marysville Road Cultural Resources Investigation | NCIC-908 | Yuba | Camptonville |
| Werner, Roger H. and Flaherty, Jay M. | 1981 | Ridge Road Cultural Resources Investigation | NEIC-1177 | Sierra | Camptonville |
| Werner, Roger and Julia Costello | 1984 | Archaeological Reconnaissance of the Deadwood Creek Water Power Project | NCIC-8401 | Yuba | Strawberry Valley |

**Table 4.1-1. (continued)**

| Author | Date | Title | NCIC/NEIC Report No. | County | Quadrangle |
|---|---|---|---|---|---|
| Wheeler, Thomas | 1980 | Marysville Road Improvement Archaeological Report | NCIC-8438 | Yuba | Camptonville |
| Wheeler, Thomas and Dan Stevens | 1980 | Studhorse Road Relocation Project Archaeological Survey | NCIC-8434 | Yuba | Camptonville |
| Whittlesey, Nicholas | 2001 | Soroptomist II Timber Harvest Plan | NCIC-2757 | Yuba | Camptonville, Challenge |
| Wiant, Wayne | 1988 | Addendum-Archaeological Reconnaissance of the Proposed New Diversion and Access Road Locations for the Deadwood Creek Water Power Project | NCIC-1005 | Yuba | Strawberry Valley |
| Windward, Stephen | 2002 | Oregon Hill Timber Harvest Plan | NCIC-7638 | Yuba | Challenge |
| Wise, David | 1999 | Jones Timber Harvest Plan | NCIC-1982 | Yuba | Challenge |

NCIC = North Central Information Center
NEIC= Northeast Information Center

For those portions of the Project located within Yuba and Nevada counties, Licensee identified a total of 149 previously recorded cultural resources on file at the NCIC. Of these, 24 sites ~~that~~ lie inside the FERC Project Boundary and the remaining 125 sites are~~or~~ within the 0.25~~-~~-mile study area surrounding the FERC Project Boundary. No previously recorded sites were identified for the Sierra County portion of the Project. The 24 sites within the FERC Project Boundary are listed in Table 4.1-2.

**Table 4.1-2. Previously recorded cultural resources within the FERC Project Boundary.**

| # | Trinomial | Primary No. | Tahoe National Forest Service No. | Recorder/Date | Site Type | Brief Description | National Register of Historic Places Eligibility |
|---|---|---|---|---|---|---|---|
| 1 | CA-YUB-0018 | P-58-0036 | N/A | Riddell/1966 | P | Bedrock mortars (x7) and midden deposits; author recommended testing; currently inundated | Not evaluated |
| 2 | CA-YUB-0019 | P-58-0037 | N/A | Riddell/1966 | P | Bedrock mortars (x5) and midden deposits; author recommended no further work; currently inundated | Not evaluated |
| 3 | CA-YUB-0020 | P-58-0038 | N/A | Riddell/1966 | P | Single depression, possible housepit; no author recommendation indicated; currently inundated | Not evaluated |
| 4 | CA-YUB-0021 | P-58-0039 | N/A | Riddell/1966 | P | Bedrock mortars (x51) and village, several areas were indicative of house pits; lithic material; excavated and reported by Humphreys (1967); currently inundated | Not evaluated |
| 5 | CA-YUB-0022 | P-58-0040 | N/A | Olsen/1966 | P | Bedrock mortars (number not indicated); author recommended no further work; currently inundated | Not evaluated |
| 6 | CA-YUB-0023 | P-58-0041 | N/A | Olsen/1966 | P | Bedrock mortars (x5); author recommended no further work; currently inundated | Not evaluated |
| 7 | CA-YUB-0024 | P-58-0042 | N/A | Riddell/1966 | P | Bedrock mortars (x13) and midden deposits; author recommended testing; currently inundated | Not evaluated |
| 8 | CA-YUB-0025/H | P-58-0043/H | N/A | Riddell/1966 | P/H | Bedrock mortars (x18) and midden deposits; possible prehistoric camp site; historic-period stage stop; author recommended excavation; currently inundated | Not evaluated |

**Table 4.1-2. (continued)**

| # | Trinomial | Primary No. | Tahoe National Forest Service No. | Recorder/Date | Site Type | Brief Description | National Register of Historic Places Eligibility |
|---|---|---|---|---|---|---|---|
| 9 | CA-YUB-0026/H | P-58-0044/H | N/A | Riddell/1966 | P/H | Lithic scatter; historic-period farm buildings one site; author recommended no further work; currently inundated | Not evaluated |
| 10 | CA-YUB-0868 | P-58-0886 | N/A | Storm/1977 | P | Bedrock mortars (x15) and pestles (x4); briefly exposed during survey (normally inundated by New Bullards Bar Reservoir) | Not evaluated |
| 11 | CA-YUB-0887 | P-58-0905 | N/A | Deen/1977 | P | Bedrock mortars (x2); briefly exposed during survey (normally inundated by New Bullards Bar Reservoir) | Not evaluated |
| 12 | CA-YUB-0894 | P-58-0912 | N/A | Storm/1977, Flaherty and Werner/1984 | P | Bedrock mortars (at least 6) | Not evaluated |
| 13 | CA-YUB-1054 | P-58-1072 | 05-17-53-00072 | Budy/1976 | P | Single depression, tool fragments, lithic debris; briefly exposed during survey (normally inundated by New Bullards Bar Reservoir) | Not evaluated |
| 14 | CA-YUB-1217 | P-58-1236 | N/A | Peak/1988 | P | Bedrock mortars (x2) and mano fragments (x2) | Not evaluated |
| 15 | CA-YUB-1574 | P-58-1918 | N/A | Flaherty and Werner/1984 | P | Bedrock mortars (x3) | Not evaluated |
| 16 | N/A | P-58-1532H | N/A | Wayland/1999 | H | Former Summit Hill Ranch, a late 1950s construction | Not evaluated |
| 17 | N/A | P-58-1579 | N/A | Boardman/ 1997 | P | Bedrock mortars (x7) | Not evaluated |
| 18 | N/A | P-58-1947H | N/A | Moine/1998 | H | Road bed, possible section of Ramm's Toll Road | Not evaluated |
| 19 | N/A | N/A | 05-17-53-00102 | Unknown[1] | U | Unknown[2] site description. | Unknown[2] |
| 20 | N/A | N/A | 05-17-53-00126 | Unknown[1] | U | Unknown[2] site description. Site may be inundated. | Unknown[2] |
| 21 | N/A | N/A | 05-17-53-00127 | Unknown[1] | U | Unknown[2] site description. Site may be inundated. | Unknown[2] |
| 22 | N/A | N/A | 05-17-53-00139 | Unknown[1] | U | Unknown[2] site description. May include/encompass site P-58-0294, located outside the APE. | Unknown[2] |
| 23 | N/A | N/A | 05-17-53-00254 | Unknown[1] | U | Unknown[2] site description; located on end of project road and needs confirmation that site is in APE. | Unknown[2] |
| 24 | N/A | N/A | 05-17-53-00340 | Unknown[1] | U | Unknown[2] site description. Site may be inundated. | Unknown[2] |

[1] Unknown = Data regarding site recorder(s) and date of recording was not available at this time and will be researched as part of the study archival research.
[2] Unknown = Archaeological Site Records for certain mapped site locations will be acquired from TNF as part of the study archival research.
H = Historic
N/A = Not Applicable
P = Prehistoric
P/H = Multicomponent (Prehistoric and Historic materials)
U = Unknown

~~of it.~~ The majority of historic period site assemblages reflect industrial mining and domestic occupations of the project vicinity; almost one-third of the historic period sites contain mining-related features. Historic infrastructure features, predominantly ditches and roads, were also

identified. Native American pre-contact sites are typical of those found throughout the region, namely locations with bedrock milling features and scatters of lithic material. Other documented pre-contact cultural remains range from an isolated projectile point to evidence of long-term occupations evinced by midden deposits, possible house pits, and other domestic features.

Many previously identified cultural resources were not evaluated for eligibility for inclusion in the NRHP. Approximately 70 percent of the surveys occurred 10 or more years ago, provide insufficient information to determine the adequacy of the coverage employed, or report methods that indicate the survey coverage was broad or otherwise did not fully cover the areas included in those projects.

A review of historical 7.5-minute United States Geological Survey (USGS) topographic quadrangles and BLM General Land Office (GLO) plats indicate that at least 45~~44~~ potential historic-era sites or features may still exist, some of which may be within the FERC Project Boundary. Potential historic sites are those places or features indicated in historic documentation (personal accounts, maps, regional histories, etc.) that may or may not still exist, and that will require ground-truthing to determine if materials associated with these places are present. Table 4.1-3 lists the potential historic-period sites or features identified within the Data Gathering Area.

**Table 4.1-3. Potential historic-period sites within the Project Data Gathering Area.**

| | Type | Description | Government Land Office Data Source (Section, Township, Range, Date) | Quadrangle |
|---|---|---|---|---|
| 1 | Transportation | Unlabeled trails | Sections 4,5 and 6, Township 19 North, Range 8 East (1878) | Strawberry Valley, Clipper Mills |
| 2 | Transportation | Valley and Foster Bar Road | Sections 16,17 and 18, Township 19 North, Range 8 East (1878) | Strawberry Valley, Clipper Mills, Challenge |
| 3 | Mining | Placer diggings | Section 13, Township 19 North, Range 7 East (1871) | Clipper Mills, Challenge |
| 4 | Residence | Bean's house and orchard | Section 13, Township 19 North, Range 7 East (1871) | Clipper Mills, Challenge |
| 5 | Mining/Irrigation | Ditch segment | Section 34, Township 19 North, Range 7 East (1871) | Challenge |
| 6 | Mining | Placer diggings, ditch, flumes | Section 36, Township 19 North, Range 7 East (1871) | Challenge |
| 7 | Transportation | North San Juan and Alleghany Road | Sections 17 and 18, Township 18 North, Range 9 East (1878) | Pike, Camptonville |
| 8 | Field | Possible agricultural field | Section 18, Township 18 North, Range 9 East (1878) | Camptonville |
| 9 | Field | Possible agricultural field | Sections 17 and 18, Township 18 North, Range 9 East (1878) | Pike, Camptonville |
| 10 | Field | Possible agricultural field | Sections 18 and 19, Township 18 North, Range 9 East (1878) | Camptonville |
| 11 | Field and residence | Possible agricultural field and residence (dot on map) | Sections 18 and 19, Township 18 North, Range 9 East (1878) | Camptonville |
| 12 | Transportation | Unlabeled trail | Sections 17,18 and 19, Township 18 North, Range 9 East (1878) | Pike, Camptonville |
| 13 | Transportation | Unlabeled trail | Sections 20 and 21, Township 18 North, Range 9 East (1878) | Pike |
| 14 | Mining/Irrigation | Ditch segment | Sections 19 and 20, Township 18 North, Range 9 East (1878) | Pike, Camptonville |
| 15 | Residence | Cabin | Section 20, Township 18 North, Range 9 East (1878) | Pike |
| 16 | Mining/Irrigation | Ditch segment | Sections 20 and 21, Township 18 North, Range 9 East (1878) | Pike Camptonville |
| 17 | Mining | Old quartz mill | Section 20, Township 18 North, Range 9 East (1878) | Pike |

**Table 4.1-3. (continued)**

| | Type | Description | Government Land Office Data Source (Section, Township, Range, Date) | Quadrangle |
|---|---|---|---|---|
| 18 | Transportation | Foster Bar Road | Sections 3,4,7,8,and 9, Township 18 North, Range 8 East (1876) | Camptonville |
| 19 | Field | Possible agricultural field | Sections 3 and 4, Township 18 North, Range 8 East (1876) | Camptonville |
| 20 | Transportation | Unlabeled road | Sections 5,6,7 and 8, Township 18 North, Range 8 East (1876) | Camptonville |
| 21 | Transportation | Bridge (over North Yuba River) | Section 7, Township 18 North, Range 8 East (1876) | Camptonville, Challenge |
| 22 | Transportation | Unlabeled road | Section 7, Township 18 North, Range 8 East (1876) | Camptonville, Challenge |
| 23 | Mining/Irrigation | Small ditch | Section 8, Township 18 North, Range 8 East (1876) | Camptonville, Challenge |
| 24 | Mining | Lot No. 37-Nevada Mining Company Placer Mine | Sections 4,8,9, and 17, Township 18 North, Range 8 East (1876) | Camptonville |
| 25 | Transportation | Road from San Juan to Camptonville | Sections 9,10,11 and 16, Township 18 North, Range 8 East (1876) | Camptonville |
| 26 | Transportation | Unlabeled road | Sections 10 and 11, Township 18 North, Range 8 East (1876) | Camptonville |
| 27 | Mining | Old gold diggings | Section 11, Township 18 North, Range 8 East (1876) | Camptonville |
| 28 | Transportation | "Old Road" and road segments | Section 13, Township 18 North, Range 8 East (1876) | Camptonville |
| 29 | Transportation | "Old Road" segment | Section 14, Township 18 North, Range 8 East (1876) | Camptonville |
| 30 | Transportation | "Old Road" segment | Sections 10 and 15, Township 18 North, Range 8 East (1876) | Camptonville |
| 31 | Transportation | Unlabeled road | Sections 16 and 17, Township 18 North, Range 8 East (1876) | Camptonville |
| 32 | Field | Possible agricultural field | Sections 17 and 20, Township 18 North, Range 8 East (1876) | Camptonville |
| 33 | Transportation | Unlabeled road segments | Sections 17,19 and 20, Township 18 North, Range 8 East (1876) | Camptonville, Challenge |
| 35 | Mining/Irrigation | Ditch | Sections 19, 20 and 29, Township 18 North, Range 8 East (1876) | Camptonville, Challenge |
| 36 | Transportation | Unlabeled road | Sections 29 and 30, Township 18 North, Range 8 East (1876) | Camptonville, Challenge |
| 37 | Transportation | Unlabeled trail | Section 30, Township 18 North, Range 8 East (1876) | Camptonville, Challenge |
| 38 | Transportation | Unlabeled road segments | Sections 1, 2, 3 and 12, Township 18 North, Range 7 East (1878) | Challenge |
| 39 | Agriculture | McConnell's Orchard | Sections 2 and 3, Township 18 North, Range 7 East (1878) | Challenge |
| 40 | Transportation | Unlabeled road | Sections 11, 13 and 14, Township 18 North, Range 7 East (1878) | Challenge |
| 41 | Transportation | Romb's Bridge | Section 13, Township 18 North, Range 7 East (1878) | Challenge |
| 42 | Field | Possible agricultural field | Section 24, Township 18 North, Range 7 East (1878) | Challenge |
| 43 | Transportation | Unlabeled trail (connects with trail in Section 30, Township 18 North, Range 8 East) | Section 25, Township 18 North, Range 7 East (1878) | Challenge |
| 44 | Transportation | Bullard's Bar Road | Sections 2,3, and 4, Township 17 North, Range 7 East (1874) | French Corral |
| 45 | Transportation | Road to San Juan | Section 23, Township 16 North, Range 6 East (1876) | Smartville[1] |

[1] In 2008, the people of this community petitioned to have the name changed to Smartsville, with an 's' in the middle of the name. However, the USGS gage refers to the former spelling of the community name. Therefore in this document, the community is referred to as such.

# 5.0 Study Methods and Analysis

## 5.1 Study Area

The study area is the Area of Potential Effects (APE), which includes all lands, Project facilities and features within the existing FERC Project Boundary, and Project-affected locations outside the FERC Project Boundary. As defined in 36 CFR § 800.16(d), an APE is:

> *the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.*

For purposes of this relicensing, the APE includes all lands within the existing FERC Project Boundary and a buffer of about 200 feet surrounding the boundary. The FERC Project Boundary and APE are shown on the maps included in Attachment A. Land ownership within the APE includes 4,306 acres of National Forest Systems (NFS) land managed by the United States Department of Agriculture, Forest Service as the Tahoe National Forest (3,140~~113~~ acres) and Plumas National Forest (1,165~~193~~ acres). Acreage within the APE and FERC Project Boundary is listed below in Table 5.1-1 by landowner and total acreage for each Project facility.~~)~~

**Table 5.1-1. Distribution of Project acreage by landownership and Project facility**

| YRDP[1] Project Facility | YCWA[1] | SPI[1] | Private [1] (other) | TNF[1] | PNF[1] | USACOE[1] | State CA |
|---|---|---|---|---|---|---|---|
| New Colgate[2] - Nevada Co. | 0 | 0 | 1.0 | 30.6 | 0 | 0 | 0 |
| New Colgate – Yuba Co. | 3249.6 | 39.2 | 117.9 | 3062.7 | 1165.6 | 0 | 0 |
| New Colgate – Sierra Co. | 0 | 26.9 | 23.6 | 47.4 | 0 | 0 | 0 |
| Acreage Subtotal | 3243.8 | 66.1 | 148.1 | | | 0 | 0 |
| Narrows No. 2[3] –Nevada Co. | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 |
| Narrows No. 2 – Yuba Co. | 1.0 | 0 | 3.3 | 0 | 0 | 16.0 | 20.0 |
| Narrows No. 2 – Sierra Co. | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Acreage Subtotal | 1.0 | 0 | 3.3 | 0 | 0 | 16.0 | 20.0 |
| | | | | | | | |
| **Total Acres** | **3250.6** | **66.2** | **3.3** | **3140.7** | **1165.6** | **16.0** | **20.0** |

1 YRDP = Yuba River Development Project; YCWA = Yuba County Water Agency; SPI = Sierra Pacific Industries; Private/Other = Private residence or other private landholding; TNF = Tahoe National Forest; PNF = Plumas National Forest; USACOE = U.S. Army Corps of Engineers;

2 New Colgate Facility includes New Bullards Bar Reservoir, New Bullards Bar Dam and Spillway, Our House Diversion Dam, Log Cabin Diversion Dam, New Colgate Powerhouse, Penstock, and Switchyard, and Access Roads within the FERC Project Boundary.

3 Narrows No. 2 Facility = Narrows 2 Powerhouse, Penstock, Switchyard, and Access Road within the FERC Project Boundary

Licensee will coordinate with tribes and agencies to identify whether there are known tribal or other cultural resources concerns outside the FERC Project Boundary for which there is a Project nexus, and consult with SHPO to seek concurrence on the APE as early as possible in the relicensing process. If YCWA proposes an addition to the Project, the APE 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~~US Fish and Wildlife Service, State Water Resources Control Board~~ 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 Survey~~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 unit~~s~~. 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 (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~~

## 5.3 Study Methods

The study methods will consist of the following five steps, each of which is described below.

### 5.3.1 Step 1 – Obtain SHPO Approval of APE

As required under Section 106 [36 CFR § 800.4(a)(1)], Licensee will submit maps depicting the APE to the SHPO for formal review, comment, and concurrence as early in the relicensing process as practicable, following the final definition of the APE.~~.~~ Once approved, the maps and~~including~~ SHPO's concurrence letter will be filed with FERC. Licensee will include in the SHPO correspondence the Cultural Resources Specialists for TNF and PNF and interested tribes, if requested.

Licensee may request that SHPO concur with a modified APE during the study if Licensee determines that the Project affects historic properties outside the previously SHPO-approved APE.

### 5.3.2 Step 2 – Archival Research

Information has been obtained from the record searches that identified previous cultural surveys and recorded archaeological and historic-era properties within or directly adjacent to the APE. Archival research will also be conducted at the repositories listed below, and others as they are identified during the study, to obtain additional information specific to the prehistory and history of the Project area, the hydroelectric system as a whole, and its individual features. The results of the archival research will serve as the basis for preparing the prehistoric and historic contexts against which archaeological and historic-era properties may be evaluated. Historical photographs located during the archival research will be cited in the text as figures and provided in a separate appendix, unless they are subject to copyright laws. Previous NRHP evaluations of Project system features, if they exist, will be used as much as possible. The places to be contacted or visited shall include:

- Oral histories, as applicable
- United States Department of Agriculture (USDA) Forest Service, Tahoe National Forest ~~(TNF)~~
- USDA Forest Service, Plumas National Forest ~~(PNF)~~
- Yuba County Library California Room, Marysville
- The Firehouse Museum, Nevada City
- Sacramento History Center and Archives
- State Library, Sacramento
- Camptonville Historical Society
- YCWA archives
- Special Collections, Meriam Library, California State University, Chico

### 5.3.2 Step 3 – Field Survey and Identification of Resources

FERC is required to make a reasonable and good faith effort to identify historic properties that may be affected by the Project. As described at 36 CFR § 800.4(b)(1), this may be accomplished through ~~sample field investigations and/or~~ field surveys that are implemented in accordance with the Secretary of the Interior's Standards and Guidelines for Identification (NPS 1983). FERC is also required to consider any other applicable professional standards and tribal, state, or local laws or procedures to complete the identification of historic properties.

#### 5.3.2.1 Archaeological Field Survey

Following completion of Step 2, Licensee will conduct a field survey to verify locations of previously recorded cultural resources and to identify previously unknown cultural resources, if present. This will be completed by examining all accessible lands within the APE. Areas within the APE that cannot be accessed in a safe manner (e.g., certain locations containing dense vegetation, or unsafe slopes) will not be included within the survey or recording of archaeological and historic-era properties; these areas will be identified in the resulting report and an explanation for survey exclusion will be provided.

Field methods will include crew members walking parallel transects spaced 15-20 meters apart. In areas containing moderately dense vegetation or moderately steep terrain, the survey strategy may employ 20–40-meter transects. All topographical features encountered in moderate areas, and considered to be sensitive for cultural resources (i.e., springs, drainages, etc.) will be thoroughly inspected. Lands typically inundated by New Bullards Bar Reservoir that become accessible during the survey season as a result of normal reservoir draw-downs also will be examined. To accommodate low water levels, the field survey of the reservoir will be scheduled to occur as close to the periods of annual low reservoir levels as possible, depending on weather conditions. Additionally, each site identified in the APE will be assessed for Project-related effects including, but not limited to, water fluctuation, wave action, and vegetation management activities.

The field survey will be supervised and/or conducted by qualified, professional archaeologists (i.e., individuals who meet the Secretary of the Interior's Standards for professional archaeologists). The field survey will be used to examine all lands within the APE that can safely be accessed and will follow the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (NPS 1983) to determine whether historic properties will be affected by the relicensing.

~~The field survey will be scheduled to occur as close to the periods of annual low reservoir levels as possible, depending on weather conditions. Additionally, each site will be assessed for Project-related effects including, but not limited to, water fluctuation, wave action, and vegetation management.~~

Locations of previously recorded cultural resources will be verified and the sites re-recorded only if their existing site records or other documentation do not meet current standards for recording, or if the condition and/or integrity of the property has changed since its previous

recording. Newly discovered cultural resources, including isolated finds, will be fully documented following the recordation procedures outlined in *Instructions for Recording Historical Resources* (OHP 1995), which utilizes State of California, Department of Parks and Recreation (DPR) forms DPR 523 A-L. A sketch map for each site recorded or re-documented will be drawn to-scale and the property photographed. The locations of all archaeological sites and isolates documented during the survey will be plotted by Licensee's cultural resources specialist or cultural consultant onto the appropriate USGS 1:24,000 scale topographic map at the time of discovery. Field personnel will use a GPS receiver to document the location of cultural resources (including isolates) discovered during the survey, which will be plotted onto the appropriate USGS topographic quadrangle using the UTM coordinate system. GPS data related to recordation of historic properties will adhere to DPR specifications for accuracy and site specific procedures. Additionally, the areas examined will be plotted onto the appropriate USGS 7.5-minute topographic quadrangle for comparison with previous survey coverage maps.

Archaeological surveys that occur on Forest Service lands will require special use permits~~valid permits. Licensee, or, as appropriate their consultants, will obtain all required cultural permits prior to examining Forest Service lands. Licensee also will notify Forest Service personnel when field work is scheduled to begin~~.

As requested by TNF, artifacts encountered during the field survey on the TNF will be left in place, no artifacts on TNF will be collected during the field survey. As requested by the PNF, time-sensitive diagnostic artifacts encountered during the field work will be collected and submitted to PNF following completion of the study. All diagnostic artifacts encountered will be documented on DPR Primary Records, their positions mapped using a GPS unit, and each artifact photographed using a digital photography format.

Licensee will schedule the field survey within New Bullards Bar Reservoir (i.e., within the normal maximum water surface elevation), to the extent surveys within the reservoir can be performed, for fall or winter, weather permitting, when annual water levels are at their lowest, as shown in Figure 5.3-1. Surveys outside the New Bullards Bar Reservoir pool will be scheduled by License at its convenience.

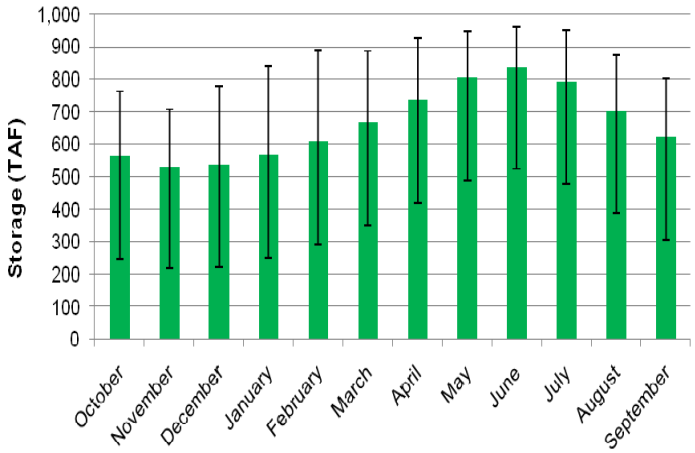


**Figure 5.3-1. Historic annual reservoir levels at New Bullards Bar Reservoir.**

#### 5.3.2.2 Historic-Era Inventory of Project System Features

A field inspection, documentation, and subsequent NRHP evaluation (see below) of the entire Project system will be undertaken by qualified, professional individuals meeting the Secretary of the Interior Standards for Architectural and Engineering Documentation. Individual components will be recorded or re-recorded to meet current DPR standards. This will include digital color photography and sketch maps of individual features that show the relationship of buildings within each compound or camp that may be associated with them. Some or all features comprising the ~~Project (i.e., hydroelectric system)~~ may not have reached 50 years of age at the time of the field survey. However, the entire Project system will be documented and evaluated~~, as appropriate,~~ for listing on the NRHP because the system~~, as a whole,~~ will soon reach 50 years of age and because it may be associated with important people that may result in an eligibility finding that supercedes the age criterion.

#### 5.3.2.3 Discovery and Treatment of Human Remains

If human remains are discovered during the field survey, the field supervisor will immediately contact Licensee and Forest Service ~~and/or BLM's~~ cultural resources specialists, as appropriate. Should human remains be identified during the survey, or any phase of work under this plan, all work in the immediate area will cease and the provisions contained within federal and/or State law and ACHP policy (ACHP 2007) will be followed. In addition to compliance with federal and State law, contacts with local Native American tribes, archaeological contractors, physical anthropologists, Licensee system operators, Forest Service; and, in some cases, the SHPO may be involved. Moreover, human remains and associated funerary objects, if any, often are viewed as sacred and must be treated with respect. Sensitivity toward all interested parties also is essential whenever human remains are concerned.

### 5.3.3 Step 4 – National Register of Historic Places Evaluation

During documentation of archaeological sites and features in Step 3, Licensee will also document the condition of each resource to assist in identifying potential project-related affects and level of integrity to provide recommendations for NRHP eligibility or evaluations. All previously unevaluated sites that can be evaluated at this phase, based on the documented remains, background research, and site conditions, will be formally evaluated for consultation with affected tribes and forest service and for SHPO consultation and concurrence. Any NRHP evaluations completed for sites located on federal agency lands~~NFS land~~ will be submitted to the appropriate agency~~Forest Service~~ for review prior to obtaining SHPO concurrence. Additionally, Licensee will consult with the participating tribes prior to submitting evaluations to TNF, PNF,~~the Forest Service~~ or SHPO regarding any values that tribes may associate with archaeological sites documented in the APE to assist in identifying properties that may be eligible for the NRHP. Archaeological resources requiring further field efforts to complete NRHP evaluations will be identified and included in Licensee's PM&Es for implementation and management outside the Study Plan, likely under a FERC-approved HPMP~~Historic Properties Management Plan~~, unless more immediate action is deemed necessary to address Project-related effects.

Licensee will utilize the National Register criteria for all sites to be evaluated, which are defined in 36 CFR 60.4, and which include the following:

> *National Register Criteria for Evaluation. The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and*
>
> **(a)** *that are associated with events that have made a significant contribution to the broad pattern of our history;*
> **(b)** *that are associated with the lives of persons significant in our past;*
> **(c)** *that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;*
> **(d)** *that have yielded, or may be likely to yield, information important to prehistory or history.*

If appropriate, and depending on the results of the archaeological field survey, the National Park Service Preservation Brief 36: Protecting Cultural Landscapes, may be taken into consideration to identify whether any cultural landscapes may be present in the APE that require management considerations.

#### 5.3.3.1 Evaluation of Historic Project System Features

Previously evaluated historic Project systems or individual features will not be re-evaluated unless substantial changes in their conditions have been observed and documented during the study, or the evaluation is more than ten years old. If deemed appropriate by a qualified, professional cultural resources specialist, individual historic-era features may be evaluated together as a district.

All previously unevaluated historic-era Project features will be formally evaluated for eligibility to the NRHP. The evaluation will consist of three tasks: 1) development of a historic context for the APE using archival research; 2) examination of each historic feature to document and assess the level of integrity, both individually and as an element of a potential Hydroelectric Historic District; and 3) the historical information and the physical site data obtained during background and field research will be used to evaluate the eligibility of each Project feature individually and as part of a potential historic district for inclusion on the NRHP.

### 5.3.4 Step 4 – Identify and Assess Potential Project Effects on National Register-Eligible Properties

As required under 36 CFR § 800.5, Licensee will identify and assess any adverse effects on identified historic properties resulting from Project O&M. Adverse effects are defined as follows:

*An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative (36 CFR § 800.5(a)(1).*

### 5.3.5 Step 5 – Reporting

Licensee will prepare a report at the conclusion of the study that includes the following sections: 1) Study Goals and Objectives; 2) Methods; 3) Results of study and identification of any other non-TCP cultural/ethnographic resources; 4) Discussion, and; 5) Description of Variances from the FERC-approved study proposal, if any. Maps~~Cultural maps~~ will be developed that clearly depict the following on USGS 1:24,000 topographic maps: the study areas examined; current inventory coverage in the areas surveyed, including intensity of coverage; and locations of cultural resources identified within the study areas.

Copies of this report will be provided to: the affected Indian Tribes; Forest Service; SHPO; CSU, Chico, NEIC; CSU, Sacramento, NCIC; and FERC. Copies without confidential or sensitive information and attachments also will be provided to the Camptonville Historical Society and/or Camptonville Community Service District. Copies of the final report and detailed locations of identified properties may be withheld from public disclosure in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA (as amended). Concurrence on report recommendations will be sought from SHPO.

As requested by FERC, a draft Historic Properties Management Plan (HPMP) will be prepared using the results of the study, in consultation with the affected Tribes, TNF, PNF, and the SHPO and included with the Draft License Application. A final HPMP will be included in the Final License Application.

## 6.0 Study-Specific Consultation

Licensee will engage in the following study-specific consultation:

- Licensee will obtain SHPO's concurrence with the APE (Step 1.)
- Licensee will notify and coordinate with potentially affected tribes and Forest Service prior to the start of the field survey to provide the proposed field schedule, obtain necessary permits from the Forest Service, and invite tribal representatives to participate in the survey (Step 3).

- Any NRHP evaluations completed for cultural resources located on lands managed by federal agencies~~NFS land)~~ will be provided to the federal agency, as appropriate, and to affected tribes for prehistoric resources,~~Forest Service~~ for review and consultation prior to submittal to SHPO for concurrence (Step 4).

## 7.0 Schedule

Documented historic annual low reservoir levels indicate that New Bullards Bar Reservoir reaches its lowest water levels in November and December, when bad weather may restrict field efforts. Licensee ~~will~~ may schedule the field survey at any time the weather permits, but will schedule survey below the high water line of ~~surveys within the~~ New Bullards Bar Reservoir ~~pool~~ for the fall to accommodate, to the extent possible, ~~-~~annual, normal drawdowns and low water levels.~~-~~ Licensee anticipates the schedule to complete the study as follows assuming the FERC issues its Study Determination by September 16, 2011 and the study is not disputed by a mandatory conditioning agency ~~PAD is filed on November 1, 2010, and FERC issues its Study Determination by October 4, 2011~~:

Archival Research (Step 1) ..... October 2011 - December 2011
Field Survey (Step 2) ..... November 2011 - April 2012
NRHP Evaluation (Step 3) ..... November 2011 - April 2012
Identify/Assess Effects on NR-Eligible Properties (Step 4) ..... November 2011 - April 2012
Report Preparation (Step 5) ..... October 2011 ~~-~~– September 2012

## 8.0 Consistency of Methods with Generally Accepted Scientific Practices

The proposed study methods discussed above are consistent with the study methods followed in several recent relicensing projects. These methods have been accepted by the participating Native American Tribes, agencies, and other interested parties associated with those projects. The methods presented in this study plan also are consistent with the ACHP's guidelines for compliance with the requirements of Section 106 of the NHPA found at 36 CFR 800.

## 9.0 Level of Effort and Cost

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

## 10.0 References Cited

Advisory Council on Historic Preservation~~ (ACHP).~~ 2007. *Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Object.* Washington, D.C.

Federal Energy Regulatory Commission and Advisory Council on Historic Preservation. 2002. *Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects*. Washington D.C.

Jackson, R., M. Boynton, W. Olsen, and R. Weaver 1988. *California Archaeological Resource Identification and Data Acquisition Program: Sparse Lithic Scatters*. Office of Historic Preservation, Sacramento.

Jackson, R., T. Jackson, C. Miksicek, K. Roper, and D. Simons. 1994. *Framework for Archaeological Research and Management on the National Forests of the North-Central Sierra Nevada*. Prepared for the USDA Forest Service, Eldorado National Forest.

King, T. 1998. *Cultural Resource Laws and Practice: An Introductory Guide*. Lanham, MD: AltaMira Press.

Office of Historic Preservation (OHP) 1995. *Instructions for Recording Historical Resources*. Sacramento, California.

Parker, P. and T. King 1998. *Guidelines for Evaluating and Documenting Traditional Cultural Properties*. *National Register Bulletin 38*. Washington, DC: U.S. Department of the Interior, National Park Service

United States Department of Interior (USDOI),~~,~~ National Park Service (NPS) 1983. *Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines in the Federal Register, September 29, 1983 (48FR44716).* Department of the Interior, Washington, D.C.

_____ 2002. *How to Apply the National Register Criteria for Evaluation. National Register Bulletin 15. Revised for the Internet, http://www.cr.nps.gov/nr/publications/ bulletins/archeology/*. U.S. Department of the Interior, National Park Service, National Register, History, and Education.

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# ATTACHMENT 1

# AREA OF POTENTIAL EFFECTS MAPS

[Relicensing Participants – APE mMaps will be provided in the Proposed Study Plan. Licensee]

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Study 13.1

# NATIVE AMERICAN TRADITIONAL CULTURAL PROPERTIES

February 11, 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 Traditional Cultural Properties (TCP).

TCPs are locations associated with cultural practices or beliefs of a living community that are: 1) rooted in that community's history; or 2) important in maintaining the continuing cultural identity of a community.[1] National Register Bulletin 38, 1998:1 (Parker and King 1998) defines a TCP as:

- Locations associated with the traditional beliefs of an aboriginal/indigenous group about its origins, its cultural history, or the nature of the world and cultural landscapes.
- A rural community whose organization, buildings and structures, or patterns of land use reflect the cultural traditions valued by its long-term residents.
- An urban neighborhood that is the traditional home of a particular cultural group, and that reflects its beliefs and practices.
- Locations where Native American religious practitioners have historically gone and are known or thought to go to today, to perform ceremonial cultural rules of practice.
- Locations where a community has traditionally carried out economic, artistic, or other cultural practices important in maintaining its historic identity.

Under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, federal agencies must take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. As defined under 36 CFR 800.16(l), historic properties are prehistoric or historic sites, buildings, structures, objects, districts, or locations of traditional use or beliefs (i.e., TCPs) that are included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). Historic properties are identified through a process of evaluation against specific criteria. For most cultural resources evaluated for listing on the NRHP, these criteria are found at 36 CFR 60.4. However, to be considered a historic property, a TCP must meet other significance criteria identified in amendments made to the NHPA in 1992. These criteria are found at §101(d)(6)(A).

[1] Historic properties other than Traditional Cultural Properties (TCPs) are addressed in a separate study proposal (Study 12.1, Historic Properties Study) in the Relicensing.

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

~~Under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, federal agencies must take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings.~~

[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 Licensee 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 by an agency or agencies 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. At a meeting held on October 1, 2010, tribes approved language stated in Section 2.0 YCWA. Licensee]

# 3.0 Study Goals and Objectives

The goal of the study is to assist the Federal Energy Regulatory Commission (FERC) in meeting its compliance requirements under Section 106 of the NHPA, as amended, by determining if licensing of the Project will have an adverse effect on NRHP-eligible TCPs, ethnographic resources, or other cultural resources of Tribal significance.

The objective of this study is to identify TCPs and other cultural resources of Tribal importance that may potentially be affected by Project O&M, evaluate their eligibility to the NRHP, and identify Project-related activities that may affect TCPs, other Tribal interests, or traditional interests of other groups within the APE.

# 4.0 Existing Information and Need for Additional Information

Licensee's Preliminary Information Package (YCWA 2009) described~~Pre-Application Document describes~~ existing, relevant, and reasonably available information regarding cultural resources, including TCPs. This information is summarized below.

## 4.1 Background Research

To gather the necessary background information, records searches and archival research were completed at two information centers of the California Historical Resources Information System;

one at the Northeast Information Center (NEIC) at California State University, Chico (CSU, Chico), and the other at the North Central Information Center (NCIC) at California State University, Sacramento (CSU, Sacramento). The record searches included: 1) a review of cultural resources records and site location maps; 2) historic General~~Government~~ Land Office (GLO) maps; 3) an up-to-date list of NRHP-listed properties; 4) the California Register of Historic Resources; 5) the Office of Historic Preservation Historic Property Directories for Yuba, Nevada, and Sierra counties; 6) 1992 California Points of Historical Interest; 7) 1996 California State Historic landmarks; 8) ~~and~~ 1976 California Inventory of Historic Resources; and 9) a search of the NEIC and NCIC files for ethnographies or other cultural reports relevant to the study.

The records searches were employed in part to identify Indian Trust Assets (ITA)[2] and TCPs within the FERC Project Boundary and adjoining area.

No TCPs, ITAs, Indian Reservations, lands designated under Tribal ownership, or any other ITAs were encountered during the research.

Therefore, additional data gathering, including additional archival and field research, is needed to augment the data collected to-date in order to identify whether TCPs could be affected by continued Project O&M.

## 4.2 Identification of Potentially Affected Native American Tribes

Licensee contacted the Native American Heritage Commission (NAHC) on March 9, 2009, to obtain a listing of tribal groups or individuals who should be notified regarding the Project. NAHC replied to this request on March 16, 2009. All individuals and organizations included on NAHC's list were contacted by telephone in April 2009~~;~~ four responded to the calls.

Additional tribal representatives with interests in the Project have also been identified through other relicensing projects. These individuals and those previously notified were both contacted in June 2009 so that Licensee could provide updates regarding the relicensing.

In July 2009, Licensee mailed to those tribal representatives identified in the Project PAD Information Questionnaires (Appendix A) to solicit concerns or additional information regarding the Project.

Additionally, all individuals contacted during the June 2009 call were invited to attend a Project information meeting on September 9, 2009, and invitations to the meeting were mailed on August 10, 2009, to each representative as well as to the United States Department of Agriculture Forest Service (Forest Service), United States Department of interior, Bureau of Land Management (BLM), State Historic Preservation Officer (SHPO) and FERC. Two

[2] ITAs are legal interests in assets held in trust by the federal government for Indian tribes or individual Indians. These can be real property, physical assets, or intangible property rights. ITAs do not include things in which a tribe or individuals have no legal interest.

individuals, both from Save the Salmon, a non-governmental organization, and no tribal members or agencies attended the September 9 meeting.

Following Licensee's initial contact with tribes and tribal representatives, three tribes initially declined participation in the relicensing process~~Relicensing~~, as described below in Table 4.2-1. Two of these tribes have since informed the Licensee that they will participate in the Project relicensing~~Relicensing~~. As of February 2011, no communications from ~~other~~ tribes other than those listed in Table 4.2-1 have been received in response to various contacts and outreach from the Licensee. Additional outreach to tribes will occur during the Study Plan implementation~~study~~ to augment current efforts to date, and to make every~~a reasonable~~ effort to contact individuals and tribes who may have an interest in the Project~~Relicensing~~. Currently, Strawberry Valley Rancheria, Enterprise Rancheria, Nevada City Rancheria, and United Auburn Indian Community of the Auburn Rancheria are actively participating in the Project r~~R~~elicensing.

**Table 4.2-1. Tribes and tribal representatives contacted as of ~~September 18, 2009~~February 2011.**

| Tribe | Individual Contacted |
|---|---|
| Berry Creek Rancheria of Maidu Indians | Jim Edwards, Chairperson |
| | Dwayne M. Brown, Jr., Environmental Coordinator |
| Concow Maidu Tribe of Mooretown Rancheria~~Butte Tribal Council Concow Maidu Tribe of Mooretown Rancheria~~ | Laura Winner, Chairperson~~Ren Reynolds~~ |
| | Guy Taylor, Director, Environmental Protection Office~~Laura Winner, Chairperson~~ |
| Enterprise Rancheria of Maidu Indians[1] ~~Enterprise Rancheria of Maidu Indians[2]~~ | Glenda Nelson, Chairperson~~Guy Taylor, Director, Environmental Protection Office~~ |
| | Frank Watson, Vice~~Glenda Nelson,~~ Chairperson |
| | Ren Reynolds, EPA Planner~~Frank Watson, Vice Chairperson~~ |
| Colfax-Todds Valley Consolidated Tribe~~[2]~~ | Lavina Suehead, Chairperson |
| | Stephen Prout, Vice Chairperson |
| | Sandy Marks |
| | Judy Marks |
| | Alicia Juelch |
| | Clyde Prout |
| | Leon Portras |
| | Marjorie J. Cummins |
| Greenville Rancheria of Maidu Indians | Kyle Self, Chairperson |
| | Crista Stewart, Environmental Manager |
| | Lacie Miles |
| Mechoopda Indian Tribe of Chico Rancheria | Michael DeSpain, Director OEPP |
| Nevada City Rancheria, Nisenan Tribe | Virginia Covert, Vice Chairperson |
| | Shelly Covert, Secretary |
| | member |
| Nisenan/Maidu | April Moore |
| Strawberry Valley Rancheria | Cathy Bishop, Chairperson |
| | Rea Cichocki |
| Todds Valley Miwok-Maidu | Jerri White Turtle |
| | Lois Zellner |
| | Brigette Zellner |
| Tsi-Akim Maidu Tribe | Don Ryberg, Chairperson |
| | Grayson Coney |
| United Auburn Indian Community of the Auburn Rancheria[3] | David Keyser, Chairperson |
| | Marcos Guerrero, Representative |
| Washoe Tribe of Nevada and California | Waldo Walker, Chairperson |
| | Darrel Cruz, THPO |
| | Rose Wood |
| | Lynda Shoshone |
| | Brian Wallace |

**Table 4.2.1. (continued)**

| Tribe | Individual Contacted or Participating |
|---|---|
| Unaffiliated Individuals | Clara LeCompte |
| | Tyrone Gore |
| | Bill Jacobson |
| | Ralph Rose |

[1] By letter dated August 12, 2009, the Enterprise Rancheria advised Licensee that "At this time Enterprise Rancheria will not be interested in the Yuba River Development Project." At a meeting held on October 1, 2010, Enterprise Rancheria informed Licensee that they will now participate in the Yuba River Development Project relicensing.

~~Per telephone communications on July 10, 2009, the Colfax-Todds Valley Consolidated Tribe advised Licensee that the Project is too far away and that they will not be participating in the Yuba River Development Project.~~

[2] ~~By letter dated August 12, 2009, the Enterprise Rancheria advised Licensee that "At this time Enterprise Rancheria will not be interested in the Yuba River Development Project."~~ ~~At a meeting held on October 1, 2010, Enterprise Rancheria informed Licensee that they will now participate in the Yuba River Development Project relicensing.~~Per telephone communications on July 10, 2009, the Colfax-Todds Valley Consolidated Tribe advised Licensee that the Project is too far away and that they will not be participating in the Yuba River Development Project.

[3] Per telephone communications on July 14, 2009, the United Auburn Indian Community of the Auburn Rancheria (UAIC) advised Licensee that the Project is out of their territory and that they will not be participating in the Yuba River Development Project. On July 28, 2010, UAIC informed Licensee via email that the tribe will participate in the Project relicensing.

# 5.0 Study Methods and Analysis

## 5.1 Study Area

The study area is the Area of Potential Effects (APE), which includes all lands, Project facilities and features within the FERC Project Boundary, and Project-affected locations outside the FERC Project Boundary. ~~The APE map is provided in Appendix B.~~

The APE may be modified if during the study, it is determined that the Project affects TCPs ~~or other resources of tribal importance~~ outside the APE.

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~~US Fish and Wildlife Service, State Water Resources~~

~~Control Board~~ 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 Survey~~Map~~ Grade Trimble GPS (sub-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 (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.~~

## 5.3 Study Methods

The study methods will consist of the following seven steps, each of which is described below.

### 5.3.1 Step 1 – Obtain SHPO Approval of APE

As required under Section 106 [36 CFR § 800.4(a)(1)], Licensee will submit maps depicting the APE to the SHPO for formal review, comment, and approval. Once approved, the maps including SHPO's concurrence letter will be filed with FERC.

### 5.3.2 Step 2 – Archival Research

Licensee will, at a minimum, conduct additional archival research at the following repositories:

- California Native American Commission

  - Sacred Lands Files
- University of California, Berkeley, The Bancroft Library,
  - Western Americana Collection
    - ✓ Native American Studies/Anthropology/Archeology/Linguistics
  - University Archives, Department of Anthropology Records
  - C. Hart Merriam Papers
  - Dorothea J Theodoratus Papers
  - Samuel Alfred Barrett Papers
  - A. L. Kroeber Papers
- California State Library, California Room
  - California History Collections
    - ✓ Manuscript Collections
    - ✓ Pictorial Resources
    - ✓ Maps
- North Central Information Center, California State University, Sacramento (CSU, Sacramento)
- Northeast Information Center, California State University, Chico (CSU, Chico)
- California State University, Chico
  - Special Collections, Meriam Library
    - ✓ NE California Collection
    - ✓ Historic Photograph Collection,
    - ✓ Historic Map Collection
    - ✓ Dorothy Morehead Hill Collection
    - ✓ The Bleyhl Collection
- National Archives and Records Administration, Pacific Region, San Francisco
  - Bureau of Indian Affairs, Record Group 75
  - Indian Health Service, Record Group 513
  - U.S. Geological Survey, Records Group 57
- Yuba County Library, Marysville
  - California Room
- Phoebe Hearst Museum of Anthropology
  - Ethnographic Collections

- U. S. Army Corps of Engineers, Sacramento District
  - Archives for the Marysville Lake Project (Parks Bar Site)
- Affected Tribes
  - Talk with Tribal ethnographers
- Review Ethnographic References
  - Littlejohn
  - Theodoratus
  - Thorn (UC Irvine or UC, Los Angeles)
  - Sherry Tatsch Dissertation (UC, Davis)
- Other appropriate repositories identified during the research

### 5.3.3 Step 3 – Tribal Consultation and Identification of Resources

Following the ethnographic literature review in Step 2, the next step in identifying potential TCPs will involve extensive tribal consultation. Consultation and any fieldwork and potential TCP documentation shall be undertaken in accordance with Section 106 of the NHPA, as amended, and shall be consistent with National Register Bulletin No. 38, *Guidelines for Evaluating and Documenting Identification of Traditional Cultural* Properties (Parker and King 1998).

In order to facilitate tribal consultation, Licensee intends to retain a qualified, professional ethnographer who meets the standards for ethnography as defined in Appendix II of National Register Bulletin No. 38. Licensee will coordinate its selection of the ethnographer with the assistance of affected tribes and other interested cultural/tribal stakeholders.

The ethnographer, in consultation with tribal representatives (i.e., Tribal Chairs, Tribal Councils, elders, as directed by the tribes), will determine the scope and breadth of interviews. The ethnographer will then contact the appropriate tribe(s) and interested tribal and cultural stakeholders to arrange for interviews at a time and location acceptable to those tribal Interviewees. Tribal interviewees and the ethnographer may need to visit the APE together to accurately define potential TCPs or other ethnographic and non-TCP cultural resources of importance to the tribes. If necessary, Licensee will arrange for an initial introductory meeting between Licensee, tribal representatives and the ethnographer.

Interviews may be conducted on a one-on-one basis with the ethnographer. The oral traditions and information collected during the interviews will be used to help define potential TCPs or other cultural resources of tribal significance in the APE and to assist in making sound judgments and management decisions in Project planning. ~~As part of this study, Tribal interviewees or other Tribal representatives may wish to develop, in coordination with the ethnographer, a listing of plants of potential interest to Tribes that may be provided to botanical~~

~~specialists implementing plant studies to assist in identifying whether any of the plants listed by Tribes are present in the APE and their locations.~~

If participating tribes do not wish to disclose the locations of any potential TCPs or other cultural resources, Licensee will instead work with the tribes to identify the general issues and concerns that the tribe(s) may have regarding potential impacts of the Project upon resources known to the tribe(s) and further work and with the tribes and appropriate land management agencies to develop agreeable measures to address these concerns.

### 5.3.4 Step 4 – Archaeological Site Visit

Tribal interviewees, or a physically capable tribal representative, and Licensee's ethnographer may wish~~want~~ to visit archaeological sites identified during the study or during Licensee's Historic Properties Study (Study 12.1). The purpose of the visit would be to provide tribal representatives the opportunity to examine any archaeological sites of interest to the tribes that were encountered during the Historic Properties Study fieldwork, and to enable the ethnographer to obtain additional information on potential TCPs that may be associated with the sites. Licensee or Licensee's ethnographer will make a reasonable effort to reach out to~~contact~~ participating tribes to invite participation in archaeological site visits by calling, sending letters by way of the U.S. Postal Service, or through electronic mail. For archaeological sites on ~~National~~ Forest Service-managed~~System (NFS)~~ land, Forest Service cultural specialists will be invited to participate in the field visits, and may want to meet in advance with tribal representatives prior to any archaeological site visits planned for Forest Service-managed lands~~NFS land~~. Licensee anticipates that the Forest Service will keep information about prehistoric archaeological sites and TCPs confidential.

### 5.3.5 Step 5 – National Register of Historic Places Evaluation

Following completion of Step 4, Licensee's ethnographer will evaluate the eligibility of identified TCPs and other cultural resources of t~~T~~ribal importance for listing on the NRHP using the data collected from the field studies described above, and in consultation with participating Tribes. Although the National Register codifies the criteria used to evaluate most cultural resources for listing on the NRHP at 36 CFR 60.4, amendments to the NHPA in 1992 [§101(d)(6)(A)] specify that properties of traditional religious and cultural importance to a tribe may be determined eligible for inclusion in the NRHP because of their *"association with cultural practices or beliefs of a living community that are: 1) rooted in that community's history; and 2) are important in maintaining the continuing cultural identity of the community."* Therefore, a TCP can only be significant and eligible for listing on the NRHP if it meets these two criteria. Other cultural resources that may be identified during this study plan will be evaluated against all appropriate NRHP criteria.

Formal TCP and any other cultural resource evaluations developed with the Tribes will be submitted to the SHPO for concurrence. Licensee will work with Tribes regarding resources of Tribal importance that may not qualify for the NRHP, or resources for which Tribes do not wish to disclose their locations, to identify the general issues and concerns that the tribe(s) may have regarding potential impacts of the Project upon resources known to the tribe(s) and further work

and with the tribes and appropriate land management agencies to develop agreeable measures to address these concerns.

If appropriate, and depending on the results of the TCP study, the National Park Service Preservation Brief 36: Protecting Cultural Landscapes, may be taken into consideration to identify whether any cultural landscapes may be present in the APE that require management considerations.

### 5.3.6 Step 6 – Identify and Assess Potential Project Effects on National Register-Eligible Properties

As required under 36 CFR § 800.5, Licensee will identify and assess any adverse effects on TCPs resulting from Project O&M. Adverse effects are defined as follows:

> *An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative (36 CFR § 800.5(a)(1)).*

### 5.3.7 Step 7 – Reporting

Licensee will prepare a report at the conclusion of the study 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.

Copies of this report will be provided to the affected Indian Tribes, Forest Service, SHPO, CSU at Chico, NEIC, CSU at Sacramento, NCIC, and FERC. Copies of the final report and detailed locations of identified properties may be withheld from public disclosure in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA, as amended. Concurrence on report recommendations will be sought from SHPO. Tribes, Forest Service, and other interested parties will be provided the opportunity to review the TCP report before it is sent to SHPO for concurrence.

As requested by FERC, a draft Historic Properties Management Plan (HPMP) will be prepared using the results of the study, in consultation with the affected Tribes, TNF, PNF, and the SHPO and included with the Draft License Application. A final HPMP will be included in the Final License Application.

# 6.0 Study-Specific Consultation

Licensee will engage in the following study-specific consultation:

- Licensee will obtain SHPO's concurrence with the APE. (Step 1.)
- Licensee will coordinate its selection of the ethnographer with the assistance of affected tribes and other interested cultural/tribal stakeholders (Step 3).
- Licensee's ethnographer will consult with tribal representatives (i.e.., Tribal Chair, Tribal Council, elders, as directed by the Tribes) to determine the scope and breadth of interviews (Step 3).
- Licensee's ethnographer will contact the appropriate tribe(s) and interested tribal and cultural stakeholders to arrange for interviews at a time and location acceptable to those tribal Interviewees. All consultation will be undertaken in accordance with Section 106 of the NHPA, as amended, and shall be consistent with National Register Bulletin No. 38, *Guidelines for Evaluating and Documenting Identification of Traditional Cultural Properties* (Parker and King 1998)~~.~~ (Step 3).
- If field visits are needed, Licensee's ethnographer will contact by telephone, U.S. Postal Mail, and/or electronic mail to invite Tribal interviewees, tribal representatives and the Forest Service, if the sites are located on Forest Service-managed land, to visit archaeological sites that may be of interest to the Tribes (Step 4).
- If appropriate, and based on the results of the study, the National Park Service Preservation Brief 36: Protecting Cultural Landscapes, may be taken into consideration to identify whether any cultural landscapes may be present in the APE that require management considerations.
- Tribes, Forest Service, and other interested parties will be provided the opportunity to review the TCP report before it is sent to SHPO for concurrence (Step 7).

# 7.0 Schedule

Licensee anticipates the schedule to complete the study proposal is as follows, assuming ~~the PAD is filed on November 1, 2010, and FERC issues its Study Determination by~~ FERC issues its Study Determination by September 16, 2011 and the study is not disputed by a mandatory conditioning agency~~October 4, 2011~~:

Planning/Pre-field Arrangements (Step 1).....October 2011 - December 2011
Field Work (Steps 2, 3 & 4).....October 2011 - July 2012
Office Work (Steps 5 & 6).....July 2012 - August 2012
Report Preparation (Step 7) .....August 2011 - ~~October~~ September 2012

## 8.0 Consistency of Methodology with Generally Accepted Scientific Practices

The proposed study methods discussed above are consistent with the study methods followed in several recent relicensing projects. These methods have been accepted by the participating Indian Tribes, agencies, and other interested parties associated with those projects. The methods presented in this study plan also are consistent with the ACHP's guidelines for compliance with the requirements of Section 106 of the NHPA found at 36 CFR 800 and with the related guidance set forth in National Register Bulletin 38. (Parker and King 1998).

## 9.0 Level of Effort and Cost

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

## 10.0 References Cited

Parker, Patricia L., and Thomas F. King. 1998. *Guidelines for Evaluating and Documenting Traditional Cultural Properties*. Revised. National Register Bulletin 38. U.S. Department of the Interior, National Park Service, National Register, History, and Education Division, Washington, D.C.

Yuba County Water Agency (YCWA). 2009. Yuba River Development Project Preliminary Information Package. September 2009.

# ATTACHMENT 1

# AREA OF POTENTIAL EFFECTS MAPS

[Relicensing Participants – APE map will be included in the Proposed Study Plan. Licensee]

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