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DEPARTMENT OF FISH AND GAME
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GRAY DAVIS, Governor

ORIGINAL

June 18, 2003

Ms. Angela Risdon
Kilarc-Cow Creek Relicensing Project Manager
Pacific Gas and Electric Company
P.O. Box 770000, Mail Code N11C
San Francisco, CA 94177-0001

Dear Ms. Risdon:

Comments on Revised Study Plans, Pacific Gas and Electric Company's Kilarc-Cow Creek Hydroelectric Project (Project) Federal Energy Regulatory Commission (FERC) No. 606

The Department of Fish and Game has received the May 2003 revised study plan document distributed by Pacific Gas and Electric Company (Licensee) for the subject Project. We appreciate the opportunity to review and comment on the study plans the Licensee proposes to implement as part of their relicensing effort. In general, the study plans appear to present a comprehensive approach to documenting the impacts of the Project on fish and wildlife resources in the Old and South Cow Creek drainages. However, for three interrelated studies involving hydrology, aquatic habitat, and instream flow, we have concerns about the adequacy of the proposed methodologies. Given the accelerated schedule for this relicensing, we understand that field work is underway and that you anticipate completing all studies this year. In an effort to provide timely input, we offer the following brief comments on three studies in particular.

Understanding unimpaired hydrology is fundamental to interpreting impacts of flow regulation on natural resources. This Project is handicapped by the lack of historic flow information and will be relying heavily on a synthesized hydrograph. The stream flow monitoring study (Study #1) proposes to place two continuous flow monitoring stations within the Project boundary at the Kilarc powerhouse on Old Cow Creek and above the diversion dam on South Cow Creek. These stations, along with biweekly measurements by Licensee personnel and powerhouse production information, will be used to calibrate and ground truth the synthesized hydrograph. The study is already limited temporally by having less than one year's worth of empirical flow measurements within the natural creek channels. To also limit the study geographically by monitoring only two continuous stations exacerbates an already data limited situation. Ideally the study should measure flow at stations that bracket all significant diversions (such as the two project canals) and inputs (such as North Canyon and Mill creeks and powerhouse discharges). Beyond the two locations proposed in your May 2003 document, we recommend that continuous flow monitoring stations also be placed above the Kilarc diversion dam and below the confluence with North Canyon Creek on Old Cow Creek

and below Mill Creek and upstream of the confluence with Hooten Gulch in South Cow Creek. Information from these added stations will facilitate extrapolation from the synthesized hydrology as well as providing a means of verifying estimated flows.

The aquatic habitat study (Study #9) has been hampered by a late start and an inability to access the study area during higher flows. We understand that the Licensee is attempting to complete the mapping as soon as feasible. We are concerned, however, that the target flow for the mapping is "base flows." The Department believes that the most useful habitat information would be acquired during moderate unimpaired flows. Based on the preliminary flow estimates provided at the back of the May 2003 document, the average unimpaired low flow during the past 50 years in September and October ranged between 25 and 35 cubic feet per second (cfs) in Old Cow Creek and between 55 and 65 cfs in South Cow Creek. Under current operations, the base flows in the bypass reaches are between 2 and 4 cfs. While flows of less than 5 cfs facilitate stream access and observation of substrate, we do not expect mapping conducted under such extreme flow conditions to provide representative habitat types. We recommend that aquatic habitat mapping be performed at flows of at least 30 cfs in the Old Cow bypass reach and at least 50 cfs in the South Cow Creek bypass reach (i.e., at the lower end of the unimpaired hydrograph) in order to capture a more representative assessment of habitat type distribution. Any data gaps resulting from constraints created by moderate flows, such as impaired water clarity or researcher safety issues, could later be addressed with a supplemental mapping effort at the base flow.

Finally, the instream flow study (Study #11) is impacted by the lack of unimpaired hydrology information as well as the incomplete habitat mapping. While we do not object to the proposed creation of a "transect selection team" the associated transect selection process provided in the document lacks detail. Department personnel with instream flow study experience have complied draft generic recommendations for transect selection processes. We enclose these recommendations entitled "Basic Sampling Design – Rule of Three Protocol" for your reference. While these recommendations are still draft and may be subject to minor revision, given the proposed field work schedule for this project, we believe they can provide useful input to on-going studies even in draft form. For example, as indicated in the enclosed recommendations, the Department considers it possible to select transects without the benefit of a comprehensive habitat mapping effort. However we do not recommend attempting to select representative transects without knowledge of the frequency and distribution of mesohabitat types at moderate flows. Prior to our participation in a transect selection team, we request the Licensee prepare a clear decision-making process (such as that offered in our draft recommendations). We believe such a road map would increase efficiency in the field as well as increase our confidence in the final selections.

Thank you for the opportunity to review and comment on the proposed study plans for the Kilarc-Cow Hydroelectric Project. We look forward to working with you and the other stakeholders to develop a balanced and complete license application. If you have any questions regarding these comments, please contact Environmental Scientist Annie Manji at (530) 225-3846.

Sincerely,

Donald Koch

DONALD B. KOCH
Regional Manager

Enclosure

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Basic Sampling Design - Rule of Three Protocol
Instream Flow Incremental Methodology
Physical Habitat Simulation Model

The applicability and utility of instream flow incremental methodology/physical habitat simulation model (IFIM/PHABSIM) weighted usable area (WUA)/discharge models and relationships is dependent upon adequately sampling mesohabitats present within specific river or stream (river) reaches, and the hydraulic and physical conditions within those mesohabitats. WUA/discharge relationships may be developed via one and two dimensional PHABSIM models. Basic sample size needs and study design(s) for one dimensional models are considered here. Two dimensional models and habitat suitability criteria, key components of PHABSIM analyses, are not considered here.

PHABSIM analyses involve sampling hydraulic and physical variables present in a river reach, simulation of these conditions at various river discharges, and interpretation of the sampling characteristics and simulation(s) results. It is virtually impossible to measure 100% of the hydraulic and physical variables at specific discharges. Thus, it was necessary to sample subsets of such variables. For most one dimensional PHABSIM analyses, this is usually accomplished by partitioning the river under consideration into generally homologous reaches, delineating available mesohabitats within each reach, and sampling specific mesohabitat units available within the homologous river reach. Hydraulic and physical conditions within these mesohabitat units are generally measured along cross-sectional transects established within the units.

Determining the number of mesohabitats and transects per specific mesohabitat to sample within specific river/stream reaches is of critical importance. Mesohabitat and transect sample sizes necessary to develop representative WUA/discharge relationships within prescribed statistical limits may be statistically determined. This approach involves developing preliminary estimates of population variance and applying formulas such as the following:

$$N = \frac{(t^2)(S^2)}{(ay)^2}$$

Where:

N	=	required sample size
t	=	tabular t-value
S^2	=	estimated variance
a	=	accuracy desired in describing the population parameters
y	=	mean in a group of n samples

To use such a statistical approach effectively, it would be necessary to identify sample size needs regarding the number of mesohabitats and types within each homologous reach as well as number of transects within each mesohabitat type and unit. Mesohabitat parameters such as type, length, width, water depth, and velocity (e.g., range, average, etc.), slope, edge type, etc., would need to be considered to statistically determine needed mesohabitat sample size(s). Parameters such as water depth and velocity, substrate, vegetation, cover type, distance to escape cover, distance to shear zones, etc. at specific stations along transects within each mesohabitat type would need to be considered to statistically determine transect sample size(s)

A statistical approach to mesohabitat and transect sample sizes, while providing a statistically valid approach to determining sample size needs, could become lengthy and costly due to the complexity, frequency, and distribution of various habitat parameters being incorporated into PHABSIM habitat modeling and due to the requirement that estimates of population variances and sample means be determined before beginning actual sampling to form the foundation of sample needs.

The Basic Sampling Design Rule of Three Protocol was developed to provide an acceptable approach to determining sample size needs for PHABSIM streamflow assessments while minimizing assessment costs. The Rule of Three Protocol is intended to incorporate effective consideration of mesohabitat and hydraulic and physical parameters occurrence and variability in the basic sample design. It is a systematic decision tree that provides stepwise decisions to determining sample size needs. It is intended to provide effective and adequate consideration of microhabitat parameters and variability within and between mesohabitats and transects to ensure these parameters are adequately sampled and to avoid high costs associated with a purely statistical approach (e.g., developing preliminary estimates of variance and other population information).

The protocol is not a statistical approach to determining sample size needs. It is intended as an alternative to a statistical approach but also intended to be an approach that takes parameter variability into consideration. The protocol approaches sample size needs from the perspective that a sample of one does not allow for within or between mesohabitat and/or transect variability to be introduced into a model. A sample size of two would allow for some variability to be introduced, but results could be biased and/or misleading if a sample unit data were somehow not representative of the overall reach. A minimum sample size of three is required to develop an estimate of variance and would minimize the potential effects of including biased/misleading sample units in the model. The protocol is intended to be applied in a collaborative manner. A minimum sample size of three mesohabitat units within each homologous reach, and three transects per mesohabitat unit is the default sample size if agreement regarding

sample size(s) cannot be reached. In specific cases, it may be appropriate to use less than or more than three habitat units and/or transects per unit. If the party conducting an IFIM/PHABSIM stream needs assessment disagrees with the protocol, use of a statistical approach to determining sample size needs and subsequent sampling is acceptable.

Pursuant to the Rule of Three Protocol, the number of mesohabitat units and transects within each unit necessarily sampled for PHABSIM model development is dependent upon river reach homogeneity, and mesohabitat frequency, distribution, and variability. Protocol procedures are:

- Partition the river segment in question into generally homologous reaches.

- Delineate all mesohabitat types (e.g., run, riffle, pool, etc.) throughout each reach at an unimpaired, moderate river discharge. Extremely low and high flows should be avoided for mesohabitat delineation

- Prepare a frequency distribution of available habitat types per river reach.

- Evaluate specific mesohabitat types that may be hazardous to sample and/or that may be exceedingly difficult/impossible to model. If all interested parties agree that specific mesohabitats should be deleted from subsequent PHABSIM sampling and modeling, determine how these mesohabitat types will be considered during stream needs assessment(s). Alternatives include interested parties agreeing upon a different assessment method if the type comprises a significant amount of a river reach, and/or if the mesohabitat includes an important function for target species; deleting these mesohabitat types from sampling, model development, and stream needs assessment(s); and assuming results of assessment evaluations for other mesohabitats will be applicable to mesohabitats that may be hazardous and/or may not be modeled. Document the decision making process, and conclusions.

- Evaluate the biological importance of each mesohabitat that comprises less than 5% of the total linear distance of the homologous reach. Include biological significant mesohabitat types in subsequent sampling, WUA/discharge development, and streamflow needs assessment(s).

- Prepare a sampling design for all samplable mesohabitats comprising 5% or greater of the total linear distance of each homologous reach and biologically important mesohabitat types comprising less than 5% of the total linear distance.

- Randomly select three units of each mesohabitat type identified in the step immediately above (e.g., three runs, three riffles, etc.) for each homologous river reach. There are various procedures to introduce randomness into mesohabitat selection. The method selected shall be determined in a collaborative manner. If an acceptable approach cannot be agreed upon by all interested parties, the complete random selection is the default. Document the decision making process and random approach selection.

- If the number of units of a specific mesohabitat type within a single reach is five (5) or less, determine if it would be appropriate to sample less than three units. This determination shall be based on the hydraulic and physical microhabitat variability present in the specific mesohabitat type, and shall be made collaboratively. If all parties cannot agree whether less than three units should be sampled, three units remains the default sample size. Document the decision making process.

- Ground truth each mesohabitat unit selected for sampling to determine whether the unit indeed does represent the appropriate mesohabitat type. Randomly select additional units as needed. Document the decision making process.

- Select locations for the three transects within each mesohabitat unit to capture locations and types of habitats used by the target species, using a collaborative decision process. Randomly placed and ground-truthed transects is the preferred approach. Document the decision making process.

- In specific, limited cases, such as hydraulically uniform or extremely simple mesohabitat units, it may be appropriate to use fewer than three transects. Evaluate each mesohabitat sample unit to determine whether three transects are needed within each unit. Determine the number of acceptable transects and document the decision making process. Transect(s) sample size decision making process shall be based on the hydraulic and physical microhabitat variability present within the specific mesohabitat type, and shall be made collaboratively. If all parties cannot agree whether less than three transects should be sampled, three transects remains the default sample size.

- Pools are an exception to the transect sample size decision making process. Pools shall have three transects (one transect randomly placed in the head, body, and tail section). This does not mean, however, that under unusual circumstances (e.g., very small pools and low habitat variability) that it would not be appropriate to evaluate whether three transects are necessary.

- Ground truth each transect selected for sampling to determine whether the transect represents the mesohabitat unit, and samples the hydraulic and physical microhabitats available within the unit. Randomly select additional transects within the mesohabitat unit as needed with ground truthing. Document the decision making process.

- Hydraulic and physical microhabitat conditions should be measured along each transect at three distinct river discharges (e.g., low, moderate, and high). It is appropriate to evaluate whether it is necessary to sample three discharges. This determination shall be based on the hydraulic and physical microhabitat variability present within mesohabitat at the three flows, and shall be made collaboratively. If all parties cannot agree whether less than three flows should be sampled, three flows remains the default sample size. Document the decision making process.

- Proceed with hydraulic and physical habitat sampling, PHABSIM model development, and streamflow needs assessment(s).