DRAFT INSTREAM FLOW METHODOLOGY STUDY PLAN
BLUE LAKE HYDROELECTRIC PROJECT (FERC No. 2230) RELICENSING

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INTRODUCTION AND PLAN PURPOSE

This Plan describes the objectives and methods for a proposed study to develop relationships between Sawmill Creek streamflows and fish habitat for selected fish species and life stages. Relicensing for the Blue Lake project requires development of these relationships to evaluate various release regimes from the project facilities. This draft Plan has been developed by the City and Borough of Sitka ("City") and its relicensing contractors, for review by members of an Instream Flow Team (IFT) representing the technical participants in this phase of study planning for relicensing.

PLAN ELEMENTS

This plan is generally based on the Expert Habitat Mapping (EHM) method described in a series of reports documenting the Oak Grove Fork by McBain and Trush. In addition to this method's major elements, we have added an hydraulic measurement component to help validate the visual habitat evaluation and to more accurately determine the extent of previously identified high-value spawning habitat at various flows.

Generally, the EHM method involves delineation of target species spawning and rearing habitat on digitized stream maps followed by field observations of changes in those habitats under a range of stream discharges.

The hydraulic component will be based on standard measurements (stage, bed elevation, and velocity) and, if deemed acceptable, data from previous hydraulic and habitat measurements (see City and Borough of Sitka, 1992).

Stream habitat at the various flows in the delineated habitat areas will be evaluated subjectively and using Habitat Suitability Index (HSI) curves or other relationships approved by the IFT.

General steps in the this process include:

1. Identify target fish species;
2. Identify life stage of interest;
3. Agree on HSI curve for each species and life stage;
4. Define reach boundaries for mapping and hydraulic measurements;

5. Map fish utilization areas;
6. Create scaled base map onto which habitat can be mapped;
7. Select field measurement teams;
8. Conduct preliminary field session to calibrate mapping teams and establish hydraulic measurement sites;
9. Release controlled flows of 50, 70, 120 cfs and conduct habitat evaluation and hydraulic measurements;
10. Digitize and compute habitat; and
11. Construct streamflow vs. habitat area by mesohabitat and life stage.

1. Identify species.

At an interagency meeting held in Juneau on December 8, 2003, it was agreed that two Sawmill Creek fish species (steelhead/rainbow trout and coho salmon) would be placed in the "high" priority category. These species and their selected life stages would be evaluated first in terms of habitat effects of altered flows.

One species, chum salmon, was placed in the "medium" priority category. This species would be evaluated after steelhead/rainbow and coho to assure that no significant negative effects were expected from flow regimes selected for the higher priority species.

Two species, pink salmon and Dolly Varden char were placed in the "low" priority category. Fish species and life stages in this category would be evaluated last relative to flow regimes accepted for higher priority species. For these species, final evaluation would assure that no critical life stages or habitat areas might be adversely affected by the selected regimes.

2. Identify Life Stage of Interest

For the selected species, life stages of interest will be identified. This process will proceed under agency approval. At the time of this draft instream flow study plan, the City proposes the following life stages for the various species described above:

Steelhead/Rainbow
Spawning
Rearing
Incubation

Coho
Spawning
Incubation
Rearing

Chum Salmon
Spawning
Incubation

Pink Salmon
Spawning
Incubation

Dolly Varden Char
Spawning
Incubation
Rearing

3. Agree on HSI Curve for Each Species and Life Stage

Generally, we propose to develop HSI curves for the various species/life stages by evaluating three different information sources.

a. Review of Literature-Based Habitat Suitability Information.

First, we will research Alaska and Pacific Northwest data for existing curves. These will be primarily those developed for Physical Habitat Simulation (PHABSIM) studies. It is expected that a significant amount of work will have been done to develop these curves for other projects and studies. Each available curve will be evaluated in terms of: Type of curve development, relative to published PHABSIM criteria, e.g., were the curves developed from literature, field study? If field study, were they developed through streamside observations, snorkeling? Was habitat availability accounted for? What is the overall quality of the curves, based on PHABSIM criteria?

b. Physical Habitat Quantification at Known Spawning and Rearing Sites.

Second, we will evaluate the high-use spawning and rearing areas of Sawmill Creek identified by Wolfe over the three years of study available. These areas, for steelhead/rainbow and coho, represent highly selected habitats since there is apparently more area available in the stream than is being used under observed escapement levels.

After delineating these sites, researchers will measure the physical parameters, particularly those directly over redds. Measurements will include depth, velocity and substrate grade. Depth and velocities will be measured using standard hydraulic techniques and a calibrated velocity meter approved by consulting agencies.

c. Development of HSI Curves.

We will use measurements from Step 2 to both evaluate the literature-based curves and to develop HSI curves for depth, velocity and substrate. We expect the steelhead and coho spawning curves to be similar, and to represent

preferences in the mid-depth and mid-velocity ranges. Through the consultation process, we will develop draft spawning and rearing curves noting the peak preferences from the literature and field studies above, and then the limits of the preference ranges. We may utilize a "physical habitat guild" concept to develop curves, noting the general slow-medium-fast or shallow-medium-deep ranges for depth and velocity for each species/life-stage.

4. Define Reach Boundaries for Mapping and Hydraulic Measurements.

This process is well underway through the mapping efforts done as part of the annual Sawmill Creek fisheries surveys. Current hand-drawn base maps include six reaches defined since the beginning of the Sawmill Creek surveys to define natural breaks in stream character and fish utilization. We propose using the existing reaches (1 through 6) and their current boundaries because of the familiar nomenclature and consistent rationale for naming.

5. Map Fish Utilization Areas.

Based on observations over the fisheries study period, stream areas utilized by steelhead/rainbow and coho salmon spawning and, to a lesser extent, rearing have been mapped in detail. These habitat areas will be transferred to the scaled base map (see following step.) Also of value in this effort will be results from the US Forest Service Tier III Stream Habitat Evaluation Process, which will be completed during spring, 2004.

6. Create Scaled Base Map onto Which Habitat can be Mapped;

The stream habitat and utilization maps will be transferred to CADD and updated electronically after each fisheries sampling effort to note stream channel features, such as substrate types, woody debris and spawning redds and to characterize various habitats within the defined reaches.

7. Select Field Measurement Teams.

Two field teams will be selected: 1) a Habitat Evaluation Team (Mapping team), and 2) a Hydraulic Measurement Team (Hydraulics team). The Mapping team will consist of biologists familiar with general Sawmill Creek environs and fishery conditions. The Hydraulics team will consist of personnel experienced with surveying and measurement of stream depths and velocities. The two teams will coordinate to the extent possible during final study planning and execution.

8. Conduct Preliminary Field Session to Calibrate Mapping Teams and Establish Hydraulic Measurement Sites.

Prior to the controlled release period, both the Mapping team and the Hydraulics team will conduct site visit(s) to familiarize themselves with the Sawmill Creek habitat areas and to plan streamside logistics.

The Mapping team will practice identifying spawning and rearing habitat by first establishing known areas and then individually identifying new areas. The Mapping team will develop written guidelines for habitat identification, and will preliminarily map the stream habitats observed.

The Hydraulics team will establish transect locations, emplace headpins or identifying marks as necessary and practice hydraulic measurement techniques within the selected areas. Also incorporated in transect selection will be knowledge of 1) the transects used for Wetted Perimeter analysis in the R.W. Beck study done for the FVU Amendment (City and Borough of Sitka, 1992), and 2) any transects measured during the US Forest Service Tier Habitat Evaluation Process.

Hydraulic transects will be selected in two types of habitats:

a. **Habitats Currently Used by the Target Species.** These are the stream areas observed to have been used consistently and which were identified in Step 5.

b. **Habitats Which Might be More Utilized if Escapement Increases.** The field teams will use both existing data and field observations to select transects and habitat areas offering potentially-acceptable habitat for steelhead/rainbow and coho spawning and rearing.

The Hydraulics team will take hydraulic measurements along transects placed to represent the habitat characteristics of the measured area and to facilitate prediction of hydraulic and habitat conditions at flows lower and higher than those actually measured.

9. Release Controlled Flows of 50, 70, 120 cfs and Conduct Hydraulic Measurements and Habitat Mapping.

The Mapping and Hydraulics teams and will observe and/or measure their respective conditions on three successive days during releases ranging from about 50 to over 100 cfs. Exact discharge rates will be determined based on reservoir elevation and weather conditions at the time of the releases. Releases will be adjusted overnight to allow stream discharge to equalize longitudinally prior to measurement.

Hydraulics Team. During each controlled release period, the Hydraulics team will measure depth, velocity and substrate at the selected transects. Transect will be measured using standard differential leveling and water velocity techniques and equipment previously approved by the IFT. At each transect, these measurements will be taken at several "verticals" or measurement points, selected to best represent existing and potential habitat areas. The Mapping team will also note cover and/or fish behavior, if applicable.

Mapping team. The Mapping team will observe the previously-selected areas during each of the three different releases. The Mapping team will delineate habitat for selected species/life-stages at each flow on the habitat base maps. The Mapping team will record habitat conditions using digital photographs and/or video. Delineations will be based on HSI information from Step 3 and on criteria established during the Mapping team calibration effort in Step 8. The output of this step will be 1) habitat maps of the selected areas showing habitat perimeters for each selected species/life stage at the three controlled flows; and 2) notes and annotations further describing habitat quality at the three different flows.

10. Digitize and Compute Habitat

Habitat Mapping. Habitat mapping will be derived from the areas mapped by the Mapping team during the controlled releases. Habitat areas (polygons) delineated by the Mapping team will be transferred to the CADD-based maps and total stream areas at each release level. A relationship between habitat for each species and life stages vs. flow will be developed and represented graphically. Exact methods for calculating habitat area will be developed and approved among members of the IFT. Habitat mapping will be used to develop flow relationships for both spawning and rearing for steelhead and coho.

Hydraulic Measurements Results of the hydraulic measurements will be evaluated in terms of depth and velocity criteria established earlier. Hydraulic measurement data will be used primarily to validate and augment the EHM analysis for spawning, but may also be used for rearing habitat if applicable measurements are obtained.

For either or both life stages, we will look for discharge "thresholds", or specific discharges at which stream area meeting spawning (or rearing) criteria increases or decreases more rapidly than usual. Such areas are often detected in wetted perimeter evaluations at flows at which channel "benches" are inundated, offering additional wetted area and suitable habitat with small flow increments.

We expect, because exact spawning locations are known and will be noted on individual cross-sections, to be able to document exact flows at which known spawning habitats are inundated, and effects of various flows, in terms of changes in depth and velocity, at those locations. Similarly, for spawning areas which are not currently utilized, we will examine depth and velocity distributions at various flows to determine the potential for spawning if escapement were greater.

For rearing, again given applicable data, we may determine general trends, noting whether habitat corresponding to rearing criteria increase or decrease with flow, and whether those trends hold under the EHM analysis. Because so little rearing is normally observed in Sawmill Creek, it will be more difficult to validate conclusions against observed fish numbers and utilization.

11. Construct Streamflow vs. Habitat area by mesohabitat and life stage.

After completion of all field measurements and observations, mapping and hydraulics data will be reduced and analyzed. Graphic streamflow vs. habitat area relationships for selected species and life stages will be prepared using both techniques and compared to show differences and similarities. Final discharge vs. habitat graphs for spawning and rearing will be constructed under review and approval of the IFT. The x-axis (discharge) for all graphs will be scaled to the finest increment possible given measurement and evaluation limitations.

The IFT will review draft flow vs. habitat graphs and, if necessary, participate in a meeting or conference call to develop final graphs to be used in relicensing instream flow negotiations.

Draft and final instream flow reports will be distributed to the IFT, and made available to all other relicensing participants.