

DRAFT BLUE LAKE RAINBOW TROUT SPAWNING SURVEY

STUDY PLAN FOR 2008

Blue Lake Hydroelectric Project FERC No. 2230 Expansion

City and Borough of Sitka, AK Electric Department

February, 2008

INTRODUCTION

This draft study plan describes proposals for monitoring rainbow trout spawning and other factors in Blue Lake near Sitka Alaska during 2008. The plan describes both field and office studies aimed at determining effects of a proposed raise in height of the Blue Lake Project dam.

BACKGROUND

The City and Borough of Sitka Electric Department (City) recently received a new license for the Blue Lake hydroelectric Project (FERC No. 2230, "Project") from the Federal Energy Regulatory Commission (FERC). During the relicensing process, the City's ongoing energy forecasts indicated that, in order to assure continued delivery of low cost electrical power in the face of rising energy needs in Sitka, it must expand its electrical generating base.

Among other alternatives, the City is examining 1) installing a third generating turbine next to the existing Blue Lake Project powerhouse; and 2) raising the height of Project dam. Study planning for the potential dam raise is prioritized in this document to assure that the final study plan will be available prior to the time period when Blue Lake rainbow trout are expected to begin their spawning migration in Spring, 2008.

ELEMENTS OF PROPOSED 2008 BLUE LAKE STUDIES

To evaluate effects of dam raising, the City proposes studies in four different areas: 1) Literature Review; 2) Temperature Monitoring; 3) Spawning, Incubation and Emergence Observations; and 4) Habitat Analysis, as described in the following:

1. LITERATURE REVIEW

The City will compile and make available in reports, all Blue Lake data gathered during the Project relicensing. These data will be from finished and reviewed reports, as well as from the City's and contractor's files. The City will also review and include, as appropriate, other relevant information on rainbow trout spawning from Alaska and the lower 48 states.

2. TEMPERATURE MONITORING

To better determine associations between rainbow trout spawning and temperatures in both Blue Lake and its tributary streams, the City will continuously monitor water and air temperature in locations selected to best represent conditions associated with spawning and incubation.

3. SPAWNING, INCUBATION and EMERGENCE OBSERVATIONS

To build on spawning surveys conducted in 2005, the City will intensively monitor rainbow trout spawning, incubation and fry emergence in Blue Lake Creek and other Blue Lake tributaries known to offer spawning habitat.

4. HABITAT ANALYSIS

Because the proposed dam raise would increase Blue Lake elevation during the spawning period, rainbow trout would be able to ascend further up Blue Lake Creek after a dam raise. This is because there is a barrier falls near the mouth of Blue Lake Creek which blocks upstream migration when the reservoir level is below about El 337 (Figure 1). Because of this barrier, only a short segment of Blue Lake Creek is currently available for spawning during the May-June spawning period because reservoir levels are usually below the barrier's elevation during that period. Water rises above the barrier elevation in the fall as the reservoir fills, but spawning is essentially complete by the time the stream's upper reaches become accessible. This barrier is called the "lower barrier"; a second impassable falls, the "upper barrier" is located about 1.9 miles upstream on Blue Lake Creek (See Figure 1).

Access into the stream reaches between the two barriers could provide extensive spawning, depending on the spawning habitat quality in the newly-accessible reaches. To determine the potential for additional spawning in these potentially-available stream reaches, the City proposes, in association with resource agency specialists, to develop and apply a method for evaluating spawning habitat in Blue Lake Creek's potentially-accessible reaches.

The City proposes to convene a Habitat Work Group in late winter and early spring, 2008. This Work Group, composed of resource agency specialists and City representatives, will develop field measurement and office analysis protocols to be applied on Blue Lake Creek. In addition to the detailed analysis of Blue Lake Creek, the Habitat Work Group will also address ways to evaluate available habitat in other Blue Lake tributaries, and the extent to which higher water elevations might affect spawning rainbow trout there.

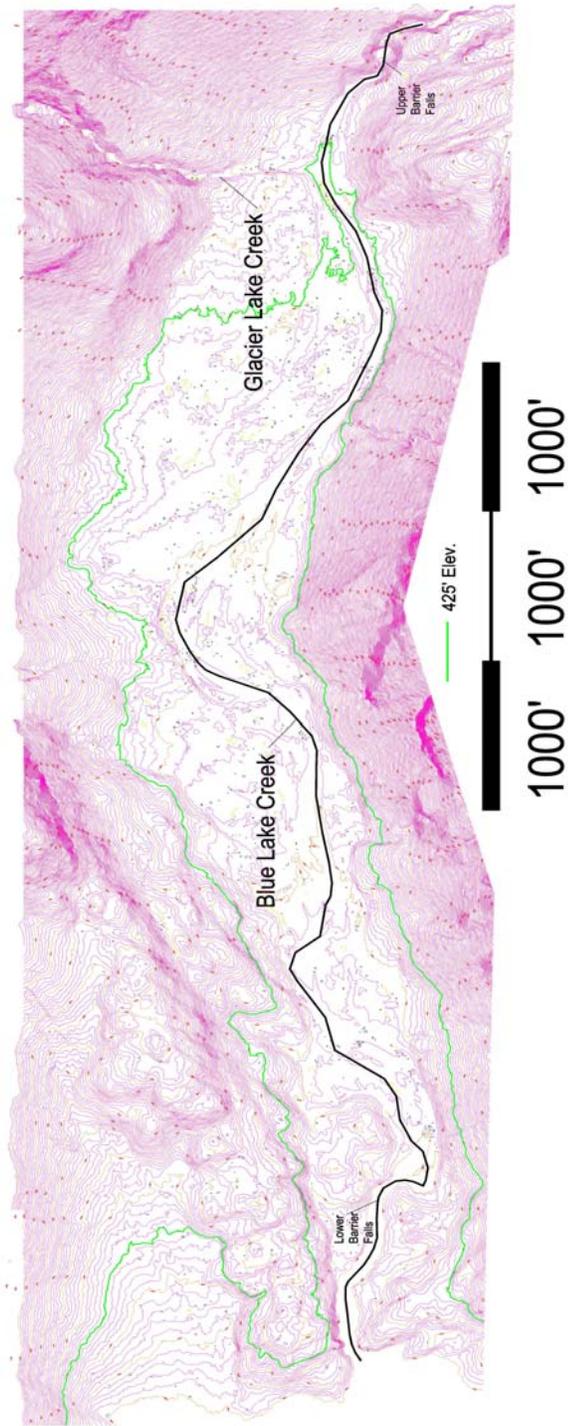


Figure 1. Blue Lake Creek Lower and Upper Migration Barriers

MATERIALS AND METHODS

LITERATURE REVIEW

The City and its contractors will review existing literature on both Blue Lake and on other comparable rainbow trout populations in Alaska and elsewhere. Available documents include, but will not be limited to:

Chadwick, Robert. 2004. Electronic Database of Historical Blue Lake Drainage Letters. ADF&G Sport Fish Division, Sitka.

City and Borough of Sitka Electric Department, 2005. Population Estimation of Adult Rainbow Trout in Blue Lake Near Sitka Alaska. Blue Lake Hydroelectric Project (FERC No. 2230) Relicensing. 23 pp.

City and Borough of Sitka Electric Department, 2005. Saw Mill Creek and Blue Lake Water Temperature Studies. Blue Lake Hydroelectric Project (FERC No. 2230) Relicensing. 16 pp.

City and Borough of Sitka Electric Department, 2005. Blue Lake Water Temperature and Rainbow Trout Spawning Studies. Blue Lake Hydroelectric Project (FERC No. 2230) Relicensing. 26 pp.

Der Hovanisian, J. A. 1994. Stock assessment of rainbow trout in a southeast Alaska impoundment. Juneau: University of Alaska. Thesis

Much of the available literature was reviewed during production of the City's temperature and spawning studies used in the Project relicensing. However, more emphasis will be placed on studies documenting spawning and rearing habitat analysis, to assist in the analyses described under "Habitat Analysis", below.

In addition, the City will further research 1) documented rainbow trout spawning in other southeast Alaska lakes and reservoirs; and 2) analyses of rainbow trout spawning in streams in Alaska and the Pacific Northwest, with emphasis on habitat utilization and quantification methods.

TEMPERATURE MONITORING

Because water temperature is an important factor in the timing of rainbow trout spawning, the City will continue to measure water temperature in Blue Lake and its tributaries. Both continuous and instantaneous temperature monitoring will be conducted, as described in the following:

Continuous Temperature Measurement

Monitoring Equipment

All continuous water temperature measurements in Blue Lake and its tributaries will be monitored using Onset Computer “Optic StowAway” model WTA08 loggers with 8 kilobyte (k) memory capacity. Specifications for these loggers may be reviewed at Onsetcomputer.com.

Loggers will be set to record temperature every two hours. With 8k memory capacity, this interval supports monitoring for 661 days before the need to download data. Data will be downloaded onsite in order to minimize gaps in the data set.

Data from each logger will be transferred in the field to an Onset Optic Shuttle. The Shuttle utilizes an Optic Coupler which holds the shuttle and logger with their optic communications windows aligned. This optical connection is immune to weather conditions and functions well underwater. Data will be downloaded to a computer in the office by connecting the Optic Shuttle to an Optic Base Station, again using the Optic Coupler.

Data Processing and Operational Software

Computer processing of logger data will be done using Box Car Pro 4.3 for Windows. We have used this system extensively and found it to be very reliable under all weather conditions. This software allows data export to an Excel format file or delimited text file, allowing analysis by almost any data processing program.

Continuous Temperature Monitoring Elements and Locations

Blue Lake continuous temperature monitoring in 2008 will consist of the following three elements:

- Blue Lake Creek and other Tributary Stream Monitoring.
- Surface Water Temperature Monitoring; and
- Lake Stratification Monitoring.

Temperature loggers will be placed at various locations in Blue Lake, Blue Lake Creek and other tributaries as described below. Locations of loggers in the earlier Blue Lake studies are shown in Figure 2 in this Draft Study Plan for reference. These locations may be changed based on agency review. Final locations will include additional loggers in various reaches of Blue Lake Creek along its entire potentially-accessible length. The locations will be noted in the Final Study Plan.

Blue Lake Tributary Stream Temperature Monitoring

Blue Lake tributary loggers will continuously monitor temperatures leading up to, during and immediately after the expected rainbow trout spawning period. These loggers will be placed in their respective tributaries during late March early April, 2008.

Loggers will be placed in Blue Lake Creek and other Blue Lake tributaries in which either rainbow trout or their fry were observed in earlier years of the study. Blue Lake Creek loggers will be placed along the Blue Lake Creek's entire accessible length to measure temperatures which might be available if trout were allowed to ascend higher in the stream at higher water levels. Also, loggers will be placed higher in other tributaries than during earlier studies, to evaluate temperatures in reaches available at higher water levels. Exact logger placement will be agreed upon between City researchers and reviewing agencies prior to March, 2008.

Loggers will be checked for operation every time researchers visit the tributaries to observe spawning, as described below. After researchers conclude that spawning is complete in 2008, we will visit the logger locations less frequently.

Surface Water Temperature Monitoring

To monitor "surface" water temperature, two single loggers will be installed: one on the "log boom" near the dam, and another in the upper end of the reservoir near the Blue Lake Creek inlet. Both of these loggers will remain about 18 inches underwater at all reservoir levels. The upper logger will document surface temperatures associated with effects from Blue Lake Creek and Becky Creek.

Lake Stratification Monitoring

To continuously monitor Blue Lake water temperature from bottom to surface, an array of 11 loggers will be attached to a line suspended near a vertical rock face. Vertical positioning (elevation relative to fixed datum) of the loggers will not change regardless of reservoir surface elevation. The array will be positioned far enough from the Project intake to minimize effects of water being drawn from the lake either over the spillway or through the intake.

In our earlier temperature stratification study, we measured temperature to a depth of about 120 feet below existing spillway level (El 345) because the exposed loggers had a

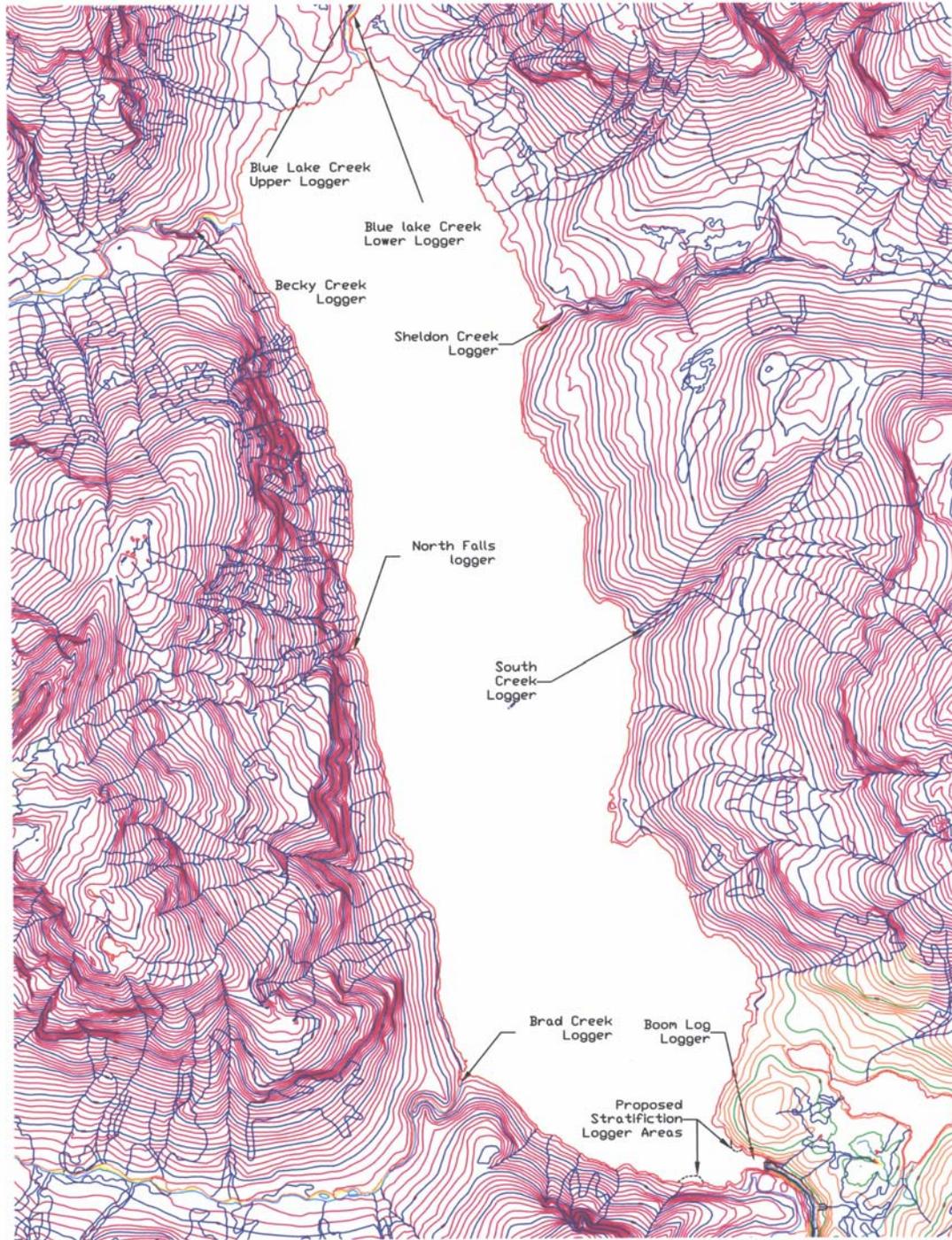


Figure 2. Blue Lake Temperature Logger Locations from Earlier Studies

depth limitation at about that depth. In 2008, we intend to measure temperature to a depth of 210 feet to better simulate stratification conditions under increased dam height(s). From El 345 to a depth of about 120 feet, loggers will be deployed every 15 feet. Loggers placed from 120 ft to 210 ft below El 345 will be spaced every 30 feet and each logger will be contained in a pressure vessel.

Continuous Temperature Monitoring Timeframe

All continuous temperature loggers will be emplaced by late March-early April, 2008, depending on access to various lake and tributary areas, and will remain active and in place through late fall, 2008, at a minimum. Experience has shown that leaving tributary loggers in place through the winter can cause damage or loss due to burial. It is expected that the loggers will be removed in late fall-early winter, 2008.

Instantaneous Blue Lake Temperature Measurement

During the rainbow trout spawning period, water temperature in the upper end of Blue Lake and selected tributaries will be measured using hand-held thermometers during each visit scheduled to service tributary loggers or observe rainbow trout spawning. These temperatures will be measured in multiple areas whether or not spawning fish are observed, to correlate tributary temperatures (from the loggers) with those in adjacent Blue Lake areas. Temperature loggers will be checked for operation and instantaneous temperature measurements, using hand-held thermometers, will be made at the logger locations to verify and, if necessary, calibrate, logger measurements.

SPAWNING, INCUBATION and EMERGENCE OBSERVATIONS

Observation Methods

Foot and snorkel surveys will be conducted to observe rainbow trout activity in Blue Lake tributaries in spring and summer, 2008. As rainbow trout are observed ascending tributaries to spawn, researchers will visit the suspected tributaries more frequently, and may even remain on the lake overnight during periods of peak activity.

Snorkel methods will be used wherever water depth and velocity do not preclude their use. A detailed habitat map of Blue Lake Creek will be developed early in the study, upon which trout spawning locations will be noted by date, temperature, and time. Similar maps will be developed for other tributaries, as data become available. Researchers will record lake level, air temperature, cloud cover, precipitation, time of day at beginning and end of survey, and other factors, on a standardized field form.

Surveys will initially be done twice per week, until spawning in-migration is noted to peak. After actual spawning is observed, surveys may be conducted daily, to assure observation of peak spawning period and location.

Observation Time Period

Earlier studies have shown that spawning occurs between mid May and July. Spawning observations will begin in April on an infrequent basis and will increase in frequency through June and July. Because some spawning in Blue Lake Creek has been observed as late as July, the observations will continue until it is determined by researchers to have ceased entirely. At that time, surveys will continue in order to document fry emergence, thought to begin by early July and continue through September.

Monitoring Data Collection And Recording

For all types of temperature and fish monitoring, dates and locations of each measurement or observation will be noted as data is collected. When possible, Global Positioning System (GPS) equipment will be used to verify locations. Where GPS will not receive satellite signals due to the terrain, the latitude and longitude of the locations will be determined from a geo-referenced orthophoto or LIDAR-developed topography.

HABITAT ANALYSIS

Blue Lake Creek

The City will conduct a habitat analysis to determine the potential for rainbow trout spawning in all accessible reaches of Blue Lake Creek. (The “accessible” reaches of Blue Lake Creek are thought to lie between two barriers, the “Lower Barrier” just upstream and upper Generally, the analytic method will involve measurement, quantification and analysis of both macro- and micro-habitat conditions. Macrohabitat factors might include: pool-riffle ratio; gradient; width to depth ratio; large woody debris; and other factors, as deemed relevant by the Habitat Work Group. Micro-habitat factors might include: substrate particle size distribution and proportion in the various stream reaches; water depth and velocity and instream or overhanging cover, all at various discharges. Stream discharge will be measured or approximated on each day when the habitat survey is conducted, to determine relationships between stream flow and certain habitat conditions.

Other Tributaries

As determined during Habitat Work Group consultation, we will also measure available habitats in other Blue Lake tributaries. The objective of these measurements will be to determine the quality and quantity of stream habitat which would be used under the reservoir’s elevation regime after dam raising.

Exact measurement and recording protocols for all habitat measurements will be approved by the Habitat Work Group prior to onset of the measurement season.

REPORTING

A draft Blue Lake Dam Raise Survey Report will be submitted prior to January, 2009. This report will describe monitoring methods and locations, and present results for all data available at the time of the report. The Report will present Introduction, Materials and Methods, Results and Discussion sections. The Report's primary objective, beyond documentation of the location, timing and physical factors affecting Blue Lake rainbow trout populations, will be to provide a basis for impact analysis of various water levels which might result from dam raising. These impact analyses will be used to support environmental analysis sections of the Application for Capacity-Related Amendment to be submitted by the City to the FERC.