APPENDIX B

STUDY PLANS

FINAL
AQUATIC RESOURCES STUDY PLAN

CASCADE CREEK HYDROELECTRIC PROJECT
FERC No. 12495-002

October 1, 2010

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1. INTRODUCTION

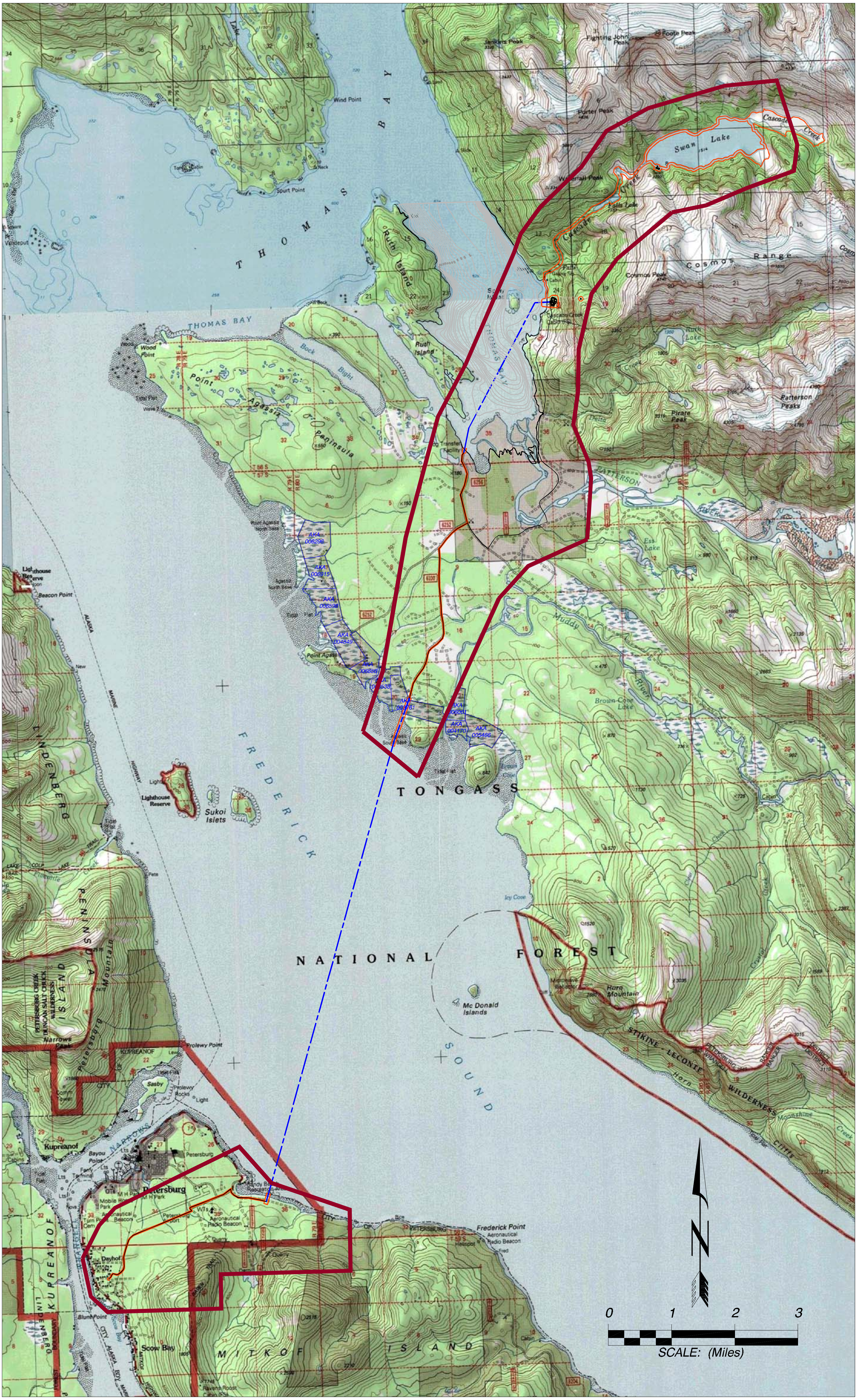
The Cascade Creek Hydroelectric Project is being developed by Cascade Creek, LLC (CCLLC) under the Federal Energy Regulatory Commission (FERC) permit No. 12495-002. The location, Swan Lake and Cascade Creek Drainage, are located approximately 15 miles northeast of Petersburg, Alaska (Figure 1).

The project consists of a lake siphon at Swan Lake, elevation approximately 1514', with a gatehouse and valve entry to an approximately three mile long 11' diameter tunnel complex of horizontal and vertical shafts. The power tunnel leads to a powerhouse at tidewater on Thomas Bay. Transmission would be a combination of overland and undersea cable to a point of connection at Petersburg, Alaska, approximately 15 miles to the southwest.

CCLLC distributed the Draft Aquatic Resources Study Plan for agency and stakeholder review in January 2010 (CCLLC January 2010). Alaska Department of Fish and Game (ADF&G) provided comments on the Draft Aquatic Resources Study Plan on March 5th, 2010. On August 12th, 2010, CCLLC hosted a meeting with agency staff to review and comment on the Draft Aquatic Study Plan. This final revision of the Aquatic Resources Study Plan incorporates agency comments on the previous versions as well as additional input from agency staff received through email, teleconferences and subsequent letters. The Aquatic Resources Study Plan is a comprehensive investigation of freshwater fishery and aquatic resources in the Cascade drainage. The Plan consists of six field investigations launched in August 2010 (Table 1.1). The study objectives and methods associated with each field investigation are described in section 2 of this Plan.

1.1. Overall Objectives

This study plan is designed to provide pre-development baseline data, which could be used to examine potential effects of hydro development associated with run-of-the-river operation approach of the proposed Cascade Creek Hydroelectric Project. Objectives of the proposed studies are to provide information suitable to: 1) Establish baseline aquatic resources data in areas potentially-affected by the Project; and; 2) Evaluate the effects of Project construction and operation in those areas.



THOMAS BAY
Wind Point
Spurt Point
Ruth Island
Swan Lake
Cascade Creek
Falls Lake
Fighting John Peak
Foote Peak
Jenkins Peak
Porter Peak
Waterfall Peak
Cosmos Peak
Cosmos Range
Ruth Lake
Patterson Peaks
Pirate Peak
Patterson River
Wood Point
Point Agassiz Peninsula
Bock Bight
Log Transfer Facility
Point Agassiz
Tidal Flat
Ess Lake
Muddy River
Brown Cove Lake
AKA 006296
AKA 006915
AKA 006598
AKA 004849
AKA 006856
AKA 006538
AKA 003761
AKA 006061
AKA 004170
AKA 005466
Lighthouse Reserve
Beacon Point
Sukoi Islets
FREDERICK SOUND
TONGASS NATIONAL FOREST
LINDENBERG PENINSULA
Icy Cove
Horn Mountain
Mc Donald Islands
STIKINE - LECONTE WILDERNESS
PETERSBURG RANGER DISTRICT
WRANGELL RANGER DISTRICT
Horn Cliffs
Moonshine Creek
PETERSBURG CREEK DUNCAN SALT CHUCK WILDERNESS
Narrows Peak
Prolewy Point
KUPREANOF
Kupreanof
Sasby I
Prolewy Rocks
Light
Petersburg
Bayou Point
Ferry Terminal
Mobile Home Park
Aeronautical Beacon
Petersburg Airport
Aeronautical Radio Beacon
Quarry
Dayhof
Blunt Point
Scow Bay
MITKOF ISLAND
Frederick Point
Aeronautical Radio Beacon
Heliport
CITY OF PETERSBURG
N
0
1
2
3
SCALE: (Miles)

1.2. Study Scope

The study plan encompasses the fishery resources in the Cascade Creek drainage as well as water quality and aquatic invertebrates in these water bodies.

1.3. Study Area

The Aquatic Resources Study Plan focuses on Cascade Creek from the intertidal zone at Thomas Bay to the 1.5 mile portion of Upper Cascade Creek upstream of Swan Lake (Figure 2). The section from the intertidal zone to the outlet of Falls Lake is referred to as Reach 1. The section from Falls Lake inlet to the outlet of Swan Lake is referred to as Reach 2. The section of Cascade Creek from Swan Lake inlet to the upstream barrier falls is referred to as Reach 3. Falls Lake, the Pond and Swan Lake are labeled as distinct water bodies from the stream reaches.

1.4. Individual Study Components

In the following sections, we define specific studies to be done in the various study areas. These study proposals generally reflect study requests made by respective resource agencies with oversight on aquatic resources. Agency comments on previous versions of the draft study plans are incorporated here. The Alaska Department of Fish and Game provided written comments on SD1 and subsequent comments submitted on March 5th, 2010 on the initial Draft Aquatic Resources Study Plan. CCLLC distributed Version 2 of the Draft Aquatic Resources Study Plan for review in July 2010. On Agust 12th, 2010, CCLLC hosted a meeting to review Version 2 of the Draft Aquatic Resources Study Plan. Agency staff provided comments during that meeting as well as written and verbal comments. The 2010 study components will include:

1. Stock Assessment and Seasonal Fisheries Inventory;
2. Fish Habitat Survey;
3. Geomorphic Study of Swan Lake Inlet;
4. Bathymetry Study;
5. Limnology Study of Swan Lake at the Penstock Intake; and
6. Aquatic Macroinvertebrate Study on Falls Lake and Lower Cascade Creek.

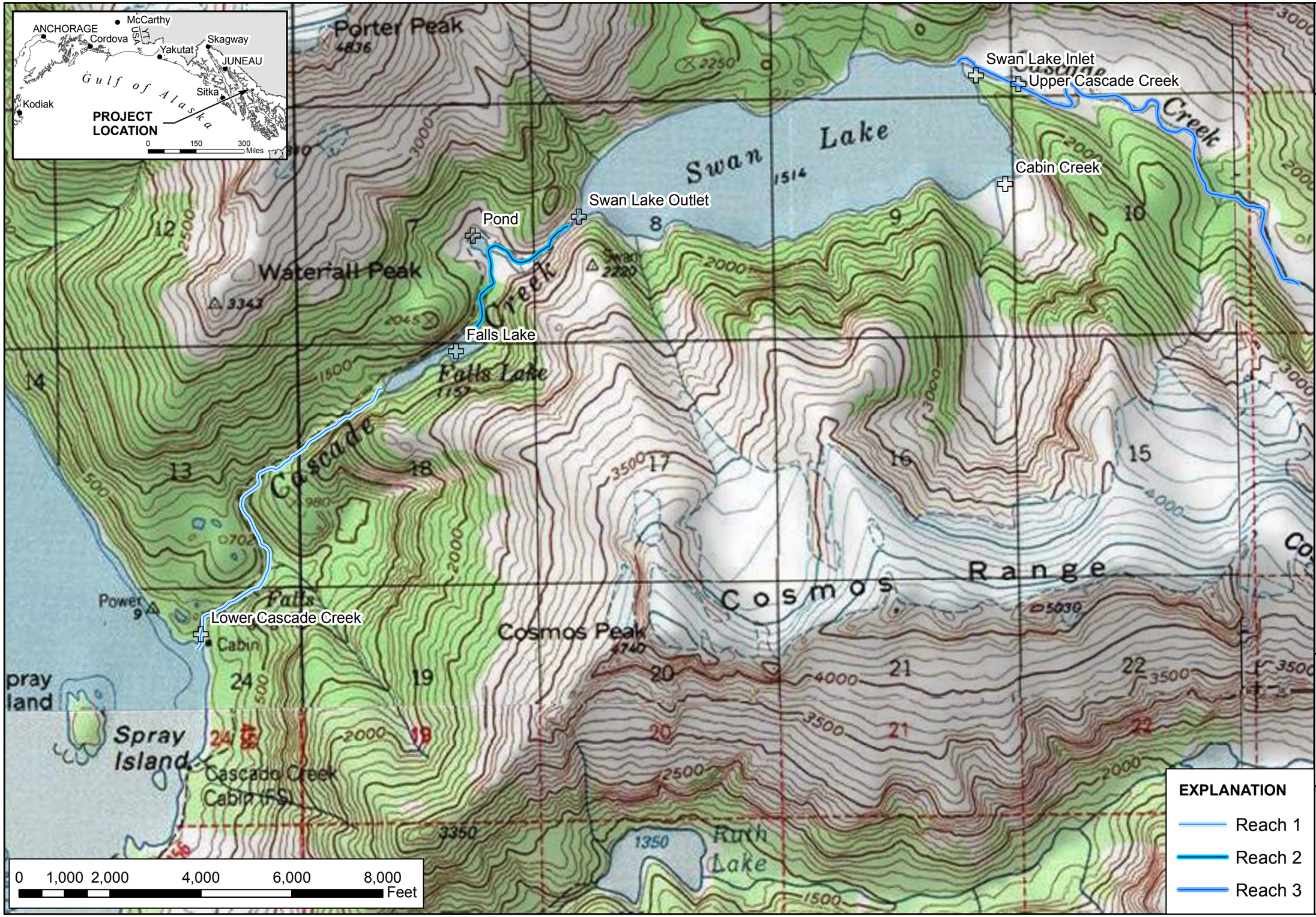


FIGURE 2

SITE LOCATION LAYOUT
STREAM STATIONING

TIDEWATER TO SWAN LAKE
CASCADE CREEK DRAINAGE
18 NW of Petersburg, Alaska

DATE: 09/03/2010
CHKD: FIELD
DRWN: A.C.M.
PROJ. No.: 637-003

825 W. 8th Ave., Anchorage, AK 99501, (907) 258-4880

oasis ENVIRONMENTAL

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Table 1-1: Proposed schedule for Aquatic Resource Study Components.

Study	Study Area	Study Year	Study period
Stock Assessment &Seasonal Fisheries Inventory	Falls Lk	2010	August/September/ November
	Lower Cascade dr	2010	August/September/ November
Habitat Survey	Upper Cascade dr	2010	August
Geomorphic Investigation In Area Of Swan Lake Major Inlet	Swan Lk	2010	August
Bathymetric Mapping	Falls Lk	2010	August
	Swan Lake Inlet	2010	August
	Tidewater	2010	August
Limnology Study of Swan Lake @ Penstock Intake	Swan Lk (at siphon depths)	2010	August / September
Aquatic Invertebrate Inventory	Falls Lk	2010	August
	Lower Cascade dr	2010	August

1.5. Rainbow Trout Fishery Background

Swan Lake was originally stocked with rainbow trout (*Oncorhynchus mykiss*) in 1957 and 1958 by the Alaska Department of Fish and Game (ADF&G). Rainbow trout are a popular species of trout targeted by anglers nationwide. Trout occur naturally in cold water stream habitats but because of their adaptability in diet and habitat use and general hardiness the stocking of this species into lakes and reservoirs is widespread throughout North America and the world where their presence supports major sport fisheries.

Rainbow trout were stocked 50 years ago and have thrived and spread into the adjacent water bodies including Cascade Creek (which both feeds and drains Swan Lake) and Falls Lake (downstream of Swan Lake). Current population and distribution information for this isolated and self-sustaining population of trout is unknown but their occurrence has been described as abundant in Swan Lake although unverified. Rainbow trout populations in Lower Cascade Creek, Falls Lake and the Pond are uncertain.

1.6. Rainbow Trout Life History Background

Rainbow trout mature between the age of 3 and 7 years and are capable of reproducing annually for many seasons. This reproductive pattern is called iteroparity (Quinn 2005) and is markedly different from salmon which spawn once then die (semelpartiy). Rainbow trout spawn in the spring and early summer beginning in May and ending in

July. Fry emerge in late spring or early summer (Quinn 2005) depending on water temperature with warmer water accelerating embryonic development. As with other salmons the female constructs a nest or "redd" by excavating gravel with their caudal fin. Eggs are laid in the resulting depression and subsequently fertilized by a male rainbow trout. This spawning strategy renders the availability of relatively loose and suitably sized gravel substrate paramount in importance for reproductive success. Rainbow trout, as well as other salmon, are also sensitive to temperature, flow and dissolved oxygen variations that are present in areas of connectivity between surface water and groundwater. These water exchange processes are collectively known as "upwelling" and occasionally "downwelling" when the direction of water movement is reversed. Zones of stream or lake bottom habitats where vertical gradients occur are preferentially selected for spawning by trout and other salmonids. The above observations of rainbow trout are general to the population and not specific to the trout at Cascade Creek or Swan Lake project area. The rainbow trout found in Cascade Creek and Swan Lake could have irregularities not mentioned here, which will be documented during the study and summarized in the final report.

2. FISHERY STOCK ASSESSMENT AND SEASONAL FISHERIES INVENTORY

In general terms and defined specifically for the Cascade Creek Hydroelectric Project a "stock" is a group of fishes, frequently a population (all individuals of the same species within a defined geographic location at a given time), believed to constitute a unique genetic resource in a fishery.

Rainbow trout inhabiting the Swan Lake-Cascade Creek-Falls lake- system represent a fragmented stock separated by physical barriers (cascades) that eliminate the possibility of upstream emigration from Falls Lake to Swan Lake. Seasonal migration occurs from Swan Lake upstream to known and unknown stream spawning areas in Upper Cascade Creek and other Swan Lake inflow tributaries. Conversely, nothing is known on migration, reproduction, and connection of rainbow trout inhabiting the Lower Cascade Creek drainage to the trout population in Swan Lake and its tributaries. Rainbow trout can emigrate downstream from Swan Lake into lower Cascade Creek including Falls Lake and the unnamed pond. The timing and frequency of these emigrations are not known. Upstream movement in Lower Cascade Creek is limited by an impassable falls directly upstream of Falls Lake. Additional upstream fish migration barriers may exist between the unnamed pond and Swan Lake. Upstream barriers are suspected in Lower Cascade Creek downstream of Falls Lake but not confirmed.

Rainbow trout of the Swan Lake-Cascade Creek system descended from trout stocked over a half a century ago, are likely a genetically distinct, isolated, and self sustaining stock. Some individuals sampled in past years have appeared visually distinct and identifiable from other trout in the region by their unique pink-red background coloration (pers. comm. D.Fleming). This fishery resource is believed to be a "monoculture" and the sole fish species inhabiting this Lake-stream system. The present study plan provides an opportunity to verify this assumption. But there remains the possibility that other fishes are present (i.e. sculpin, Dolly Varden etc.) either through human introduction or natural immigration.

Due to the fact that the rainbow trout stock in the system appear fragmented by the one or more upstream physical barriers, for the purposes of this study each discrete portion of the watershed will be considered individually. This project will assess the rainbow trout stock for Falls Lake and the unnamed pond upstream of Falls Lake only and a seasonal fishery inventory for Lower Cascade Creek only.

Other terms to be defined that are pertinent to the ongoing investigation are stock structure and stock assessment. Stock structure is the proportional distribution of sizes, ages, or genders in a stock resulting from processes of recruitment, growth, and mortality (Murphy and Willis 1996). Stock assessment studies the status of a fish stock as well as the possible outcomes of different management alternatives. The present study plan deviates from this "classical" definition of stock assessment because "length-based" stock assessments and management are more commonly used in Southeast Alaska largely owing to the direct application to length-based regulations. Moreover, the determination of accurate age and in many cases sex of rainbow trout and other game fish often requires confirmation using lethal sampling means. Non-lethal ageing of scales is possible but problematic (i.e. scale annuli are very small and close together in slow growing, coldwater fish) and must be verified through more destructive sampling techniques (e.g. otolith interpretation) or with known aged fish through longer-term studies. In addition, for rainbow trout, the results of the recruitment, growth and mortality portions of a stock assessment may be obfuscated by the reality of adult trout predation on juvenile trout. For the purpose of this project the planned stock assessment focuses on size (length and weight) and stock abundance (estimate of the number of individual rainbow trout in Falls Lake and estimate of the number of individual rainbow trout in pond). A mark and recapture sampling program is planned to estimate rainbow trout stock abundance. Unplanned, incidental mortalities will be opportunistically sampled to determine sex, diet, and age (scale and otolith analysis).

2.1. Study Objectives

The study is designed to evaluate and document the status of the rainbow trout stock of Falls Lake and Lower Cascade Creek during the pre-development phase of the Cascade Creek Hydroelectric Project. The specific objectives of the Rainbow Trout Stock assessment are:

1. Estimate the abundance of the rainbow trout stock of Falls Lake through mark-recapture (M-R) sampling (all sizes vulnerable to sampling gear) during summer and fall, 2010.
2. Estimate the abundance of the rainbow trout stock of the unnamed pond through mark-recapture sampling (all sizes vulnerable to sampling gear) during summer and fall, 2010.

3. Assess the size structure and of the rainbow trout stocks in Falls Lake and unnamed pond through length-frequency analysis.

4. Determine sex of captured rainbow trout, when and if possible.

5. Characterize fish presence/absence in Lower Cascade Creek on a bi-monthly (two-month intervals) basis.

2.2. Stock Assessment and Seasonal Fishery Inventory Methods

This section describes the rainbow trout stock assessment methods that will be used to estimate stock abundance, size structure, age, sex ratio and co-occurrence of other species in Falls Lake and Lower Cascade Creek.

Stock abundance of rainbow trout in Falls Lake and the unnamed pond downstream of Swan Lake will be accomplished through mark and recapture experiments conducted in 2010. In order to capture seasonal trends, two sampling events will occur in 2010 (August-September and November-December).

Fish will be captured in Falls Lake with minnow traps and hoop nets baited with Betadine-treated salmon eggs. Fish will be captured in Lower Cascade Creek with minnow traps baited with Betadine-treated salmon eggs. These capture techniques will be supplemented as necessary by hook and line sampling in Falls Lake but not in Lower Cascade Creek where steep terrain and shallow water would make angling hazardous and ineffective. Marking fish will utilize a variety of partial fin-clips to allow accounting for movements between discrete sampling areas. Captured rainbow trout in Falls Lake will be marked with an upper caudal fin clip. Rainbow trout captured in the pond will be marked with a Lower caudal fin clip.

Visual Implant Elastomer (V.I.E.) tags will be used to mark fish during subsequent collection trips to distinguish between fish previously marked with fin clips as well as add locations in Lower Cascade Creek. The elastomer is a 2-part polymer that produces a brightly colored liquid which hardens into a flexible, color-coded tag when injected subcutaneously. The V.I.E. tagging method, when properly applied, has high rates of tag retention and is less likely to affect the behavior, growth, or swimming performance of fishes than other tagging methods (Bailey et al. 1998; Olsen and Vollestad 2001). Another advantage to V.I.E. tags is that they can be used to mark very small fish. In previous studies, OASIS has successfully tagged fish as small as 4 mm in total length and there are reports of successful V.I.E. tags implanted in even smaller salmonids

(Olsen and Vollestad 2001). More information on V.I.E. tags and a reference list of case studies can be viewed on the manufacturer's website: http://www.nmt.us/index.htm

In Falls Lake minnow traps and hoop nets will be distributed across shallow and deepwater habitats. Angling will be employed where practicable and time permitting. Suitable locations for minnow trapping in Lower Cascade Creek will be limited by the predominantly cascade habitat and limited safe access. Traps will be placed opportunistically between Swan Lake and the Pond, between the Pond and Falls Lake and in accessible areas downstream of Falls Lake. Traps will also be placed between tidewater and the first barrier falls on Lower Cascade. Minnow trapping efforts in Lower Cascade Creek will focus on presence/absence and fish movement as opposed to abundance estimates.

An absolute abundance estimate of the spawning population will be made using Chapman's modifications of the Peterson estimator (Seber 1982) which among many similar formulae has a strong theoretical basis and is widely used in fisheries studies (Hayes et al. 2007):

$$N = \frac{(n_1 + 1)(n_2 + 1)}{(m_2 + 1)} - 1$$

Where n1 = number caught and marked in the first sampling period; n2 = number caught in second sampling period; and m2 = number of marked fish in second sampling period.

This equation will yield an absolute estimate of abundance if the following assumptions can be met (Hayes et al. 2007):

1. The population is geographically closed with no immigration or emigration,
2. The population is demographically closed with no births or deaths,
3. No marks are lost or missed,
4. Marking does not change fish behavior or probability of capture,
5. Marked fish mix at random with unmarked fish, and
6. All fish have an equal probability of capture that does not change over time.

Falls Lake and pond, treated as individual water bodies, are not completely closed systems in that immigration can occur from Swan Lake (upstream) and potentially emigration into Lower Cascade Creek (downstream). However, emigration during the mark recapture study is expected to be small relative to the size of the population and this meets the criteria for assumption 1 for use of the Chapman estimator. Adult fish will be captured and marked for this study using appropriate size classes that account for potential cannibalism of smaller fish in the population balanced with the need for adequate sample size. Mortality during the mark and recapture study is expected to be small relative to the size of the population so the criteria for assumption 2 is met. Assumptions 3 and 4 for use of the Chapman estimator will be met through careful fin clipping and field crew training.

A time period approximately one month in duration between marking and recapture dates will pass to allow for the random mixing of marked and unmarked fish (meets assumption 5) and to lessen effects of the sampling gear (trap happiness since they will be baited). Standardized sampling gear deployment will ensure that all fish have an equal probability of capture throughout the duration of the mark and recapture spawning study (meets assumption 6). Knowledge and stock abundance estimates from the first year's study will help to guide mark-recapture studies in 2011.

A Seasonal Fishery Inventory of Lower Cascade Creek will take place during the previously specified dates using minnow traps. The same gear fished in a similar manner and time of year can provide a reasonable index of change in stock abundance (Murphy and Willis 1996). Catch per unit effort (CPUE) with active or passive gear (such as minnow traps) can be used as an index of population density although true density will be unknown, i.e. CPUE is proportional to stock density (Murphy and Willis 1996). If the proportionality (another unknown) is constant then changes in CPUE indicate corresponding changes in species abundance (Murphy and Willis 1996). For these reasons the Seasonal Fishery Inventory of Lower Cascade Creek will provide valid baseline abundance indices for that water body.

During fish capture activities associated with the mark and recapture studies, individual fish will be measured (to the nearest mm total length (TL)) and released immediately or shortly thereafter if anesthesia is deemed necessary for measurement of length. This will establish baseline size information for trout present in the respective study areas. Incidental mortalities will be documented and fish kept for further analysis (otolith

interpretation). Spatially explicit capture and release information will be documented in field notes and by GPS waypoint.

The computer program MARK (White and Burnham, 1999; Colorado State University) will be used to analyze all rainbow trout mark-recapture data and for calculating stock abundance estimates in Falls Lake and pond. The Stock Assessment Report will include summarize results from the mark-recapture investigation. Additionally, the report will describe the assessment model, or the collection of mathematical and statistical techniques that were used to perform the stock assessment.

A draft report will be submitted prior to December, 2010 summarizing the mark-recapture effort in August, September and November. The report format will include the following: Introduction, Materials and Methods, Results and Discussion sections. Further mark and recapture sampling in 2011 will be captured in a subsequent report in November 2011. The 2010 report's primary objective will be to support environmental analysis for a FERC license application by CCLLC.

3. FISH HABITAT SURVEYS

This section describes the study objectives and field methods used to investigate fish habitat in upper Cascade Creek and the Spring Creek at the upper end of Swan Lake.

3.1. Study Objectives

The primary objective of this study is to characterize existing fish habitat and geomorphic baseline conditions in Upper Cascade Creek and the adjacent spring creek flowing into Swan Lake, in sufficient detail to provide the licensing participants a sound understanding of current conditions and to provide baseline information as a basis for continued monitoring post-development.

The specific objectives include:

1. Inventory geomorphic characteristics in both stream systems
2. Characterize existing fish habitat conditions, using USFS R10 survey methods

3.2. Fish Habitat Survey Methods

The USFS Region 10 (2001) sampling protocols for Tier II surveys will be employed, and supplemented with a longitudinal elevation profile of the streambed linked to vertical control monuments. Field staff will also note presence/absence of rearing fry. The Tier II survey was designed to provide consistent, quantitative estimates of habitat parameters necessary to evaluate the condition of a stream relative to USFS forest riparian habitat management objectives (RHMO). OASIS will employ the standard R10 classification scheme to characterize any and all distinct channel process types encountered during the survey. The Tier II surveys provide sufficient detail to characterize existing conditions, given the limited spatial extent of the project effects on these streams. The Tier III survey protocol, while more detailed than Tier II, does not yield sufficient additional information for a reasoned evaluation of project impacts and mitigation options to warrant its application. If side channels to the main Cascade Creek exist, they too will be surveyed according to the Tier II protocol.

Standard survey tools (auto level and stadia rod) will be used to take geomorphic measurements of the channel and a laser rangefinder to capture dimensions of all habitats encountered. As circumstances dictate, all measurements will be recorded on standard USFS data field forms, if desired, to facilitate entry in to the agency database.

3.2.1. **Study Area**

The survey area will include the main channel of upper Cascade Creek above its confluence with Swan Lake, and will include a survey of the main channel upstream to impassable falls (~ 1 mile in length, as conditions permit). Due to the paucity of high resolution air photos, it cannot be determined if there are additional side channels that would also need to be surveyed, so for now our assumption is that there are none. Adjustments in the survey effort can be made if this assumption is found to be incorrect. Tributary junctions from adjacent hill slopes will be noted as to location, and GPS coordinates will be recorded if GPS signal detection is attainable. Since these tributary habitats are not affected by the project, we propose no other habitat characterization in these waters. Additionally, a survey of the spring creek adjacent to upper Cascade Creek will be completed up to the bifurcation in the stream for a length equal to ~ 1100 linear meters.

No habitat surveys are proposed for lower Cascade Creek, which flows from the outlet of Swan Lake, to an extremely steep gradient dominated by cascades. A longitudinal gradient profile of lower Cascade Creek will be provided depicting the gradient. In addition, an aerial video shot from a helicopter at low elevation will be provided to the agencies for review of the habitat in lower Cascade Creek to better understand why this area is being omitted from further habitat study.

The survey will include a geomorphic description of the delta at the confluence of Cascade Creek and Swan Lake to a depth of ~ 2 meters. The results will address concerns for erosion of the delta feature if the project were to involve lowering lake levels beyond that currently experienced under normal annual fluctuations, or timing of lowering the lake level relative to runoff inflow.

3.2.2. **Survey Schedule**

Field work will be completed in early August of this year, assuming agency concurrence with study plans allowing timely deployment. If delayed, the alternate dates for completion of the field survey are in early September of 2010.

3.2.3. **Survey Analysis and Final Reporting**

Analysis will include compilation and narrative and graphic summaries of data on the standard habitat and geomorphic metrics listed below, as defined in the survey protocol. These results will be integrated with the fisheries survey study to provide a comprehensive picture of ecological conditions in the aquatic environment.

Once the field survey is completed, the data will be compiled and analyzed within 2 months of the survey, and a final report will be completed by the end of November, 2010.

3.2.4. **Outline of Survey Metrics and Protocols:**

Using the USFS Tier II Survey protocols (USFS 2001), (See discussion starting on pg. 27 of the Stream Habitat Survey methods manual), the following data will be collected:

- Length of stream surveyed
- Channel bed width
- Pool characteristics
- Record number and dimensions of qualifying pools
- Residual pool depth
- Beaver pond location and dimensions (if they exist)
- Large wood loading (number of pieces per channel width)
- # of Key Pieces of Large Wood (minimum qualifying dimensions = minimum diameter = 0.1 meters; length = 1 meter)
- Location (by unit and by Zones)
- Disturbance noted (landslides, bank erosion)
- Side channel measurements (if applicable)
- Length of all side channels.
- Streambank location (left or right bank) and distance of side channel inlet and outlet relative to an LLID or GIS segment node.
- Approximate average channel bed width of side channel.
- Minimum required residual pool depth.
- Channel bed width measured at a distance of every fifth approximate average channel bed width.
- Note whether the channel is flowing, intermittent, or dry.
- Number of qualifying macro pools.
- Number of qualifying pieces of large wood & key pieces scaled to the average channel bed width of the side channel.
- Maximum pool depth and pool tail crest depth.

- Longitudinal stream bed profile.
- Presence/absence of rearing fry.

4. SWAN LAKE INLET GEOMORPHIC STUDY

A geomorphic survey will be conducted to characterize existing conditions and physical processes for Upper Cascade Creek and the delta formed at its confluence with Swan Lake. The spatial extent of the survey on Upper Cascade Creek will include the area from the delta at Swan Lake upstream to the impassible falls, a distance of approximately 1 mile. In addition, physical characteristics of the delta will be recorded to a depth of two meters linked to a vertical control monument and integrated to the bathymetry mapping conducted in 2008 by Biosonics. An additional geomorphic survey of the Spring Creek will be conducted for a distance of approximately 2000 feet or as determined applicable to meet study objectives.

4.1. Study Objectives

The study is designed to document geomorphic conditions and note dominant physical processes within Upper Cascade Creek from the impassable falls to its confluence with Swan Lake and to describe the conditions at the delta. The specific objectives include:

1. Characterize existing channel conditions and dominant processes in Upper Cascade Creek.
2. Characterize existing channel conditions in the Spring Creek
3. Characterize existing conditions of the delta at the confluence of Upper Cascade Creek and Swan Lake.
4. Establish benchmarked longitudinal stream profiles throughout the spawning streams, that include mapped measurement of depth, velocity, and substrate.
5. Examine and characterize existing inlet stream behavior in relation to predictive modeling of stream response to atypical patterns of drawdown timing (i.e. what happens when/if the lake remains drawn down from hydro operation at the time when a major snowmelt release event occurs?)

4.2. Geomorphology Survey Metrics and Protocols:

OASIS will use standard survey equipment to conduct the survey, including an auto level and a survey rod. As needed, additional base elevations will be established with survey grade GPS if available. For the fluvial systems, the USFS Tier II Survey (USFS 2001)

protocol will be used to conduct this survey. (See description starting on pg. 15 of methods manual)

Channel Morphology Measurements will include the following:

- Channel characteristics
- Channel incision, depth & entrenchment ratio (where applicable)
- Bankfull stream width and depth
- Channel gradient
- Stream channel pattern
- Channel sinuosity
- Substrate
- Sampling procedure (Wolman 1954)
- Particle size analysis (D50, D84, and cumulative size fraction)

5. BATHYMETRIC MAPPING

The bathymetric study will investigate three distinct water bodies: 1) the shoreline of Thomas Bay adjacent to the powerhouse tailrace and proposed dock, 2) Falls lake; and 3) the inlet to Swan Lake complementing the geomorphology investigation in the same area. The bathymetric study will provide a high-resolution elevation model for the respective water bodies of the subsurface topography documenting habitat characteristics and potential for changes. Lake-bottom depth readings will be recorded using an autonomous underwater vehicle (AUV) equipped with side-scanning sonar and GPS navigational systems. The resulting bathymetric dataset will be a geospatially accurate depiction of subsurface relief to be used to generate topographic contour maps as well as provide a foundation for depth modeling and analysis.

5.1. Study Objectives

The study is designed to collect lake-bottom topographic information of the near shoreline for Thomas Bay, Falls Lake and Swan Lake inlet to demonstrate habitat characteristics and potential changes from project construction and operation. Reduced pool elevations in Falls Lake and Swan Lake may lead to changes in food production, access to spawning habitat as well as juvenile habitat availability influencing foraging and predation. For Falls Lake and Swan Lake, the study is designed to capture a baseline shape, volume, littoral zone and habitat to assess the effects from future drawdown. The specific objectives include:

1. Develop a 1-ft resolution subsurface terrain model;
2. Provide a baseline to document potential changes in pelagic and littoral zone habitats;
3. Predict the available habitat area for a given pool volume;
4. Evaluate project operations relative to connectivity to spawning habitat in Upper Cascade Creek and adjacent spring creek; and
5. Evaluate potential impacts on shoreline habitats in Thomas Bay associated with project infrastructure.

5.2. Bathymetric Survey Methods

A desktop analysis of lake geometry and orientation will ensue prior to field mobilization to develop a general survey transect arrangement. The survey will be designed with the

appropriate coverage to achieve a 1-ft vertical resolution elevation model. An initial survey transect plan will be loaded into the AUV system. This initial survey will be designed to provide general subsurface terrain characteristics to identify areas of concern such as shallow patches and other sources of impediments. Another pre-deployment activity will include a review of the forecasted GPS array on the horizon during planned field acquisition times to allow technicians to minimize collecting data during periods of peak dilution of precision.

Upon arriving onsite, technicians will install monumentation to establish the relative vertical position to which water depths will be recorded. These monuments will be linked to the existing staff gage at Falls Lake. This will provide a common reference point for any subsequent surveys to be used in analyzing change detection. Also, this monument can be surveyed into existing benchmarks in the future, if needed, to verify ellipsoids and transform to a datum survey based on mean sea level.

The AUV system will be deployed from the shore of the respective water bodies and set to rove along its initial planned survey route. GPS accuracy will be assessed during this time to review the capacity of the AUV's internal orientation system to operate in this area based on GPS positioning. The AUV is equipped with Doppler Velocity Log that relies on GPS precision for orientation. Several potential factors can negatively influence GPS precision at this site including the rugged surrounding terrain and northern latitudinal position on the globe. If it is determined that GPS will not suffice at this location the AUV will be set to utilize its dead reckoning capabilities for accurate navigation.

After completion of the initial survey, technicians will review the general characteristics of the subsurface layout and design a refined survey grid to avoid potential impediments and collect enough side-lap coverage to achieve the required 1-ft resolution dataset.

The AUV will output ASCII file raw data. Technicians will post-process GPS data collected during the survey and apply differential corrections based on nearby Continuously Operating Reference Station (CORS). A final review of the raw survey data will occur prior to returning from the field effort.

5.2.1. **Study Area**

The survey area will comprise the entire Falls Lake extent measuring approximately 2400' by 400' and covering 17 acres as derived by USGS 1:63,360 topographic maps. The Thomas Bay investigation will focus on a 1,000 feet section of shoreline between

the outlet of Cascade Creek and the U.S.Forest Service Cabin. The Swan Lake Inlet investigation will focus on the area between the Swan Lake pool elevation gage and the rock outcrop to the south of the inlet.

5.2.2. **Survey Schedule**

Field work will be completed in mid August.

5.2.3. **Survey Analysis and Final Reporting**

Analysis will involve extracting the raw survey data into an ArcGIS shapefile of points and projecting the data to the local UTM Zone 8 projection, as well transforming to the North American Datum of 1983. The shapefile will undergo a kriging process for the creation of a 1-ft resolution digital elevation model (DEM). A 1-ft interval contour dataset will be interpreted from the DEM to provide subsurface isobath line work in support of cartographic production.

6. SWAN LAKE LIMNOLOGY INVESTIGATION

The Swan Lake limnology investigation will focus on Swan Lake physical and chemical parameters water quality parameters. Measurements will be made of the lake's water temperature, pH, dissolved oxygen, and conductivity to determine the depth and thickness of the lake's epilimnion and thermocline in mid-summer. Concerns regarding gas supersaturation the tailrace will be addressed through literature review and a summary report accompanying the limnology report.

6.1. Study Objectives

The study is designed to describe the baseline conditions of temperature, dissolved oxygen (DO), pH, and conductivity within Swan Lake near the proposed intake. The specific objective is to: Identify and describe the dissolved oxygen and temperature depth profiles and temporal variations during summer months within Swan Lake in the vicinity of the proposed intake. The description will illustrate the stratification of the lake, and the depth, the thickness, and changes in thermocline and epilimnion.

6.2. Schedule

Measurements will be taken once per month in August and September 2010.

6.3. Location and depth

Measurements will be obtained in the water column at the location where the proposed intake will be located. Measurements will be obtained from the surface to a depth of sixty-five (65) feet depth, with measurements taken every two (1) feet from water surface to a fifty (50) foot depth, and every five (5) feet from fifty-five (55) foot to a seventy (65) foot depth. The location and depth will be calculated by first (1) identifying the lake surface elevation and (2) subtracting the intake top elevation from the water surface elevation to identify the intake distance below the surface.

6.4. Measurement parameters

Measurements will be made of dissolved oxygen, temperature, pH, and conductivity.

6.5. Method

The thermocline is a distinct layer of water in a lake at a transition between the mixed, warmer water nearer the surface and colder deep water. Seasonal weather variations and local environmental conditions affect thermocline depth and thickness. Calculating

the thermocline from water temperature data will be done with electronic instruments. Samples will be obtained initially at the surface then 1 feet increments below the water surface and measurements will continue at successive depths, noting when the temperature drop-off marks the top of the thermocline. The probe will be lowered until the coldest temperature stops decreasing with depth. This depth will be recorded as the bottom of the thermocline. Measurements will continue until a depth of 65 feet is reached.

OASIS will use a YSI 556 field meter for all parameters. The staff using the meter will be trained and have experience in use of the meter, and will also have knowledge of the range of readings for each parameter. The meter will be subject to a strict program of control, calibration, adjustment and maintenance. Prior to mobilization, maintenance will include a visual inspection that all parts are present, attached correctly and devoid of any obvious contamination. Routine maintenance on the YSI will be conducted according to schedules described in the manual provided by the manufacturer and recorded in the maintenance log stored in its carrying case. The meter will be correctly calibrated prior to each sample event using known and valid standards. In-situ calibration for DO will be also performed to correct for local barometric pressure. Following data collection post-calibration will be done to determine the reliability of the data and to identify if “drift” in parameter values occurred, to minimize problems with data interpretation and trend analyses. All calibration measurements will be recorded on the appropriate field forms or in field logbooks and available for review by upon request.

6.6. Evaluation of data collected

Analysis for the primary parameters of temperature and dissolved oxygen will be conducted using time-series analysis. Correlations between temperature and DO will be developed through regression analysis and confidence intervals calculated at a significance level of 0.05. Analyses for the other parameters will be primarily qualitative. The analysis will provide description of the enable lake stratification and summarize the baseline data for dissolved oxygen, temperature, pH, and specific conductance.

7. SEASONAL BENTHIC MACROINVERTEBRATE INVENTORY

Benthic macroinvertebrates (BMI) are an essential component in the ecological processes of an aquatic ecosystem, due to their position as consumers and intermediate trophic level of lotic food webs (Hynes 1970; Wallace and Webster 1996). BMI are included in many state and federal agency biological monitoring programs because of their significant functional roles coupled with their vulnerability to flow regulations and water quality perturbations (Barbour et. al. 1999). BMI are advantageous for biological monitoring because they are ubiquitous, have a high species diversity offering a spectrum of responses to environmental stress, and their life cycles offer analysis of effects from stochastic and intermittent disturbances (Rosenberg and Resh 1993).

7.1. Study Objectives

The study is designed to document BMI composition in lower Cascade Creek. The specific objectives of the Benthic Macroinvertebrate Inventory include:

1. BMI community composition
2. BMI density longitudinally in Lower Cascade Creek

7.2. Benthic Macroinvertebrate Study Methods

This section describes the methods used to investigate BMI in lower Cascade Creek. BMI will be sampled at four locations on Cascade Creek: Site 1) outlet to Swan lake; Site 2) directly upstream of the Pond on Cascade Creek; Site 3) pelagic zone of Falls lake; and 4) midway down lower Cascade Creek between Falls lake and the initial barrier falls. These sample locations will provide a representation of the BMI community in Cascade Creek across the elevation gradient. Sample sites were selected, in part, based on availability of safe sampling locations in Cascade Creek. Sites were also selected to avoid the lake outlet effect of Swan Lake, the Pond and Falls Lake.

Riffle habitats are the preferred stream habitat for comparative studies of benthic macroinvertebrates. Riffle habitats typically have the highest densities and diversity of benthic macroinvertebrates. Most benthic macroinvertebrate sampling devices are designed for riffle habitats relying on the transport of organisms by the current velocity into a net after disturbance by field staff.

Three replicate BMI samples will be collected in riffle habitat with cobble substrate at respective sample sites using a surber sampler with 500 µm mesh. The surber sampler covers a 20 cm square area of the stream. The substrate will be disturbed to a depth of 10 cm. Individual substrate will be scrubbed clean of attached material and organisms. Five replicate samples will be collected at each site in August 2010. Sampling in the Falls Lake pelagic zone will be done using a zooplankton net with a 30.5 cm diameter. Three replicate vertical tows will be done from the lake bottom to the surface.

The surber sampler is the most common device used for sampling benthic macroinvertebrates in stream habitats. The surber sampler is specially designed for sampling riffle habitats. This device requires disturbing the substrate through scrubbing of substrate material. Organisms are carried downstream by the current velocity into the net then transferred into a sample jar. This technique permits the surber to quantify BMI densities for a defined area. Densities are typically expressed as the number of organisms per square meter. The quantitative nature of the sampler is important because it allows for comparison of BMI densities in riffle habitats at other sites in the same stream as well as other streams. Furthermore, densities can be compared to studies by other researchers to put the data in perspective.

Samples will be preserved in 90 percent Isopropyl alcohol. Identification and enumeration will be performed by an accredited lab. Species densities will be expressed as the number of organisms per square meter in the case of the surber sampler and the number per cubic meter for samples collected in Falls Lake. The data may require electronic truncation of some taxonomic groups (e.g., chironomid midges and oligochaetes) before metrics are calculated. The final product of the laboratory analyses will be a table of the raw taxonomic data and a list of all macroinvertebrate taxa and the abundance per sample for all samples. This data will form the basis for calculating metrics, determining ecological association indices, calculating metrics and multivariate analyses (truncation may be required to ensure that the number of samples sufficiently exceeds the number of variables). Metrics will be calculated to assess taxonomic abundance in terms of function in the ecology of the system.

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CULTURAL RESOURCES STUDY PLAN

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CASCADE CREEK HYDRO PROJECT FERC# 12495-002

Proposed Final Hydrology Study Plan

Cascade Creek LLC

March 2010

BACKGROUND

In February, 2008, Cascade Creek Limited Liability Corporation ("CCLLC") received a Preliminary Permit ("Permit") for the Cascade Creek hydroelectric Project (FERC No. 12495-002, "Project") from the Federal Energy Regulatory Commission (FERC) in Washington D.C. The Project would be located approximately 15 miles N.E. of Petersburg, Alaska, and would affect Swan Lake, Falls Lake and Cascade Creek. The Project is described in detail in Scoping Document 1 (SD1, CCLLC May, 2009) prepared by CCLLC.

Generally, the Project would consist of an intake structure and an outlet control structure at Swan Lake, a power conduit consisting of a mostly unlined 12 foot diameter tunnel and steel penstock leading to a powerhouse located at tidewater on Thomas Bay. Installed capacity of the Project would be approximately 70 megawatts (MW). The current operational proposal is to draw water from Swan Lake in such a way as to minimize un-natural lake level fluctuations, with final drawdown prescriptions determined based on further economic and environmental considerations.

During Initial Consultation and Scoping, Project Stakeholders including Alaska state and federal resource agencies indicated concern for Project effects on hydrology resources relative to Swan Lake (primarily due to seasonal drawdown), Falls Lake (due to inflow changes and effects on lake level) and Cascade Creek, due to dewatering. Other concerns included changes in lake and stream water temperature regimes and effects of construction on water quality. This study plan intends to respond to study requests made during the Project review process and is the final step in developing a study plan approved by all consulting parties.

PROJECT APPROACH

Task 1- Stream Gaging Requirements.

1.1 Cascade Creek LLC (CCLLC) met with agency staff of Alaska Department of Fish & Game (ADF&G) and the U.S. Forest Service (USFS) on 7/23/08 to determine that there would be four stream gaging sites located as follows:

1) The mouth of Cascade Creek upstream of the lowest falls at the prior USGS gaging site. *(This gage has been installed.)*

2) At the outlet of Falls Lake. *(This gage site was subsequently moved to the midpoint of Falls Lake to provide safer physical access in proximity to a helicopter landing and has been installed.)*

3) At the outlet of Swan Lake. *(This gage site was subsequently moved to the east end of Swan Lake to provide safer physical access in proximity to a helicopter landing and avoid potential ice flows that accumulate near the outlet. This gage has been installed.)*

4) At the inlet of upper Cascade Creek where it enters Swan Lake. *(This gage has been installed approximately 1500' upstream of Swan Lake on the Cascade Creek inlet.)*

1.2 Gages will incorporate materials, equipment, installation techniques, calibration, monitoring, maintenance and reporting methods that are compliant with USGS stream gaging protocols.

1.3 CCLLC will make a good faith effort to accomplish the gage installations in the least invasive manner possible, being placed on or within rock substrate whenever feasible, avoiding vegetation removal or soil disturbance to the extent possible and comply with all agency permit conditions.

1.4 CCLLC will provide a site map indicating specific gage locations. The Alaska Department of Fish & Game and US Forest Service shall approve all final stream gaging locations and plans via applicable permit mechanism or letter of authorization.

1.5 Gage installation, calibration, monitoring and reporting shall be performed by personnel with demonstrated abilities and credentials appropriate for the tasks.

1.6 CCLLC will provide a photo record of each completed installation for agency review.

1.7 Gages are anticipated to be established and maintained for an indefinite period of time sufficient to determine natural resource management stream flow and hydropower operational parameters. Gages may be ordered to be moved, modified or removed at any time at agency discretion as may be necessary to protect natural resources and/or the public interest.

1.8 Each gage and related equipment will otherwise be removed when it is determined that the use and benefit is no longer needed, or as may be ordered by the agencies. CCLLC will be responsible for all work to remove equipment and restore each site as may be necessary to a natural condition.

1.9 CCLLC will provide periodic reports or information updates to the agencies as determined by the ADF&G and the USFS.

Task 2-Acquisition of Permits.

2.1 CCLLC will make application for a USFS Special Use Permit inclusive of the Stream Gaging Study Plan and all necessary plans & exhibits to adequately describe the gaging facilities, their installation and operation. *(A Special Use Permit Application has been made and approved, now subject to the revision of the Swan Lake outlet site #3 being moved to the east end of Swan Lake.)*

2.2 Presently it is not anticipated that a field reconnaissance for archeological/historical/cultural resources will be necessary due to the minimal surface area impacted and the primary placement on rock substrate wherever feasible. No significant disturbance of the ground surface would occur as a result of installation of stream gages.

2.3 CCLLC will verify with ADF&G and ADNR whether any field permits are required for establishment of stream gaging stations and comply accordingly.

Task 3-Selection and Acquisition of Field Equipment.

3.1 CCLLC has selected bubbler type pressure transducers, gage shelters, and hardware that will be owned by the project and dedicated to the stream gaging program. The important benefit of a bubble type pressure transducer is the actual transducer remains dry in the gage house and is not subject to damage caused by long term or repeated freezing in the stream. CCLLC has found that wet pressure transducers exposed to freezing water could become unreliable and often subject to either inaccurate stage measurements or destruction of the transducer membrane. CCLLC has purchased Design Analysis H350 XL instrumentation that includes a bubbler, pressure transducer and data logger.

Task 4-Transport.

4.1 All materials, equipment and personnel will be transported by air when feasible and by boat when necessary. Winter conditions may prevent access to some of the sites until sufficient visibility and other conditions allow. No alteration or disturbance of the landscape is anticipated as a result.

4.2 Trip frequency will be based on 3-5 days for initial equipment installation, up to 9 scheduled monitoring visits per year, plus 2-3 additional visits that may occur when there is the probability of rare or extreme discharge events.

Task 5-Placement of Stream Gages.

5.1 CCLLC has installed all 4 gages.

5.2 CCLLC will establish a photo record and field notes of each installation for review by the agencies as may be desired.

Task 6-Monitoring, Maintenance, and Data Processing.

6.1 Gage monitoring and maintenance will be completed at appropriate intervals for a period of at least 3 years following gage installation. The field staff will always be accompanied by another person. These visits will be to perform observation, recording and maintenance and to take high flow discharge measurements. Discharge measurements during mid and low flows will generally be taken by wading with a current meter. During high flow, staff will use an Acoustic Doppler Current Profiler (ADCP) to safely and accurately measure discharge.

6.2 Tasks during gage servicing will include:

1) Take an accurate measurement of the stream flow with a current meter or ADCP

2) Download all data from data logger

3) Program the data logger after download

4) Read all staff gages and recorder to ensure gage height match

5) Check instrument and intakes for proper operation

6) Check for debris or scour on the hydraulic control

6.3 CCLLC will compile discharges and stage data for each station, compute rating curves, and plot discharges against existing rating to check for minor and major shifts. Stage data may be adjusted for such things as backwater from debris or ice. Shift adjustments and new or revised rating curves will be applied to the stage data as warranted. All adjustments and shifts to the data will be clearly noted. Discharge data from each gage will be collected and kept on file.

6.4 Options that may be completed dependant on time & budget could include:

1) Install solar panels at each station. This will enhance battery life and reduce the time and problems during monitoring. It is possible that this will save data during the winter months when delays can be expected due to prolonged bad weather.

2) Install a GOES communication system at one or more sites. This will allow remote access to site data and give real-time updates of stream conditions while verifying that the instrumentation is functioning as expected. The result will reduce the likelihood of lost data and to time field visits when the desired flow conditions are occurring.

Task 7- Results

7.1 Data Reports will be made available to requesting agencies as soon as possible upon collection and processing. Data results summaries will be posted on the www.thomasbayhydro.com public information website.

RECREATIONAL RESOURCES STUDY PLAN

CASCADE CREEK HYDROELECTRIC PROJECT (FERC NO. 12495-002)

CASCADE CREEK LLC

September, 2010

BACKGROUND

In February, 2008, Cascade Creek Limited Liability Corporation (CCLLC) received a Preliminary Permit for the Cascade Creek Hydroelectric Project (FERC No. 12495-002, "Project") from the Federal Energy Regulatory Commission (FERC). The proposed Project would be located approximately 15 miles N.E. of Petersburg, Alaska, and has the potential to affect the existing Swan Lake, Falls Lake and Cascade Creek (Figure 1).

Generally, the Project would consist of an intake structure and an outlet control structure at Swan Lake, a power conduit consisting of a mostly unlined 12 foot diameter tunnel and steel penstock leading to a powerhouse located at tidewater on Thomas Bay. Installed capacity of the Project would be approximately 70 megawatts (MW). CCLLC proposes to operate the Project within Swan Lake's normal, seasonal lake fluctuations - where outflow is equal to inflow – to avoid effects to the lake and shoreline. It expects final management prescriptions, based on further economic and environmental considerations, to be included in the Project's FERC license application in consultation with the agencies. The Project is described in detail in Scoping Document 1 (SD1), issued for the Project by the FERC on May 21, 2009 and SD2 submitted to FERC and stakeholders in September 2010.

During Initial Consultation and Scoping, Project Stakeholders, including Alaska state and federal resource agencies, indicated concern for project effects on recreational resources within the project area and close proximity. As discussed in SD1 and SD2, construction and operation of the Project may influence recreation within the Cascade Creek/Swan Lake basin and near-shore areas of Thomas Bay, which are contained within the US Forest Service (USFS) Tongass National Forest. Construction activities such as blasting, barge traffic, vegetation clearing, and the use of heavy equipment for the installation of project facilities will create noise and landscape disturbance that may temporarily disrupt or diminish the recreational quality and aesthetic character of Thomas Bay. In addition, project construction and operation may affect recreational use of Swan Lake, Falls Lake, the Cascade Creek Trail, and the lowermost reach of Thomas Bay, including USFS recreation facilities.

The issues to be evaluated by this study, as outlined in the SD2, are:

- Effects of project construction and operation on the use of Swan Lake, the USFS Swan Lake Cabin, and Thomas Bay and the near-shore USFS Cascade Creek and Spurt Cove cabins; including associated recreational uses of sightseeing, hiking, boating, fishing, hunting, camping, and related activities.
- The need for any new recreation facilities and/or public access at the Project to meet current and future (over the term of any new license) recreation demand, including any barrier-free access needs.
- Visual effects of a new powerhouse, tailrace, and transmission transition sites.
- Effect of development of the project on visual amenities as seen from the Cascade Creek Trail and Swan Lake.
- Effects of construction noise (blasting, tunneling, hauling, truck idling) to residents and visitors.
- Visual effects of reduced water flow over Cascade Creek waterfalls.

This Revised Study Plan intends to respond to study requests made during the scoping process, as well as comments received from the agencies on the 1st and 2nd draft study plans.

GOALS AND OBJECTIVES

This study plan is designed to address baseline data needs which will allow CCLLC and Stakeholders to evaluate potential project effects on recreational resources. The study plan will also assess the importance of visual resources to recreational users. This study plan serves to outline the goals and objectives necessary to identify current and potential recreational use, opportunities, and needs at the Project, as follows:

1) develop an inventory of existing and potential future recreational resources within the project area of potential effect including Swan Lake, Falls Lake, Cascade Creek, and Thomas Bay in the vicinity of the proposed Project;
2) evaluate existing and potential future recreation use of existing recreation resources within the areas potentially affected by the Project;
3) solicit information on the public's preferences and perception of recreational and visual resources in the project area; and;
4) evaluate the effects of project construction and operation on recreational uses and visual resources within the affected areas.

PROJECT NEXUS

The construction and operation of the proposed Project may affect the current recreational setting and aesthetic character of the project area. Construction activities may have noise impacts to areas surrounding the project construction footprint. While CCLLC intends to develop a powerhouse design that incorporates both topographical and vegetative buffers, constructed facilities may affect the visual quality of Thomas Bay in the vicinity of the powerhouse. While within the natural flow parameters of the

watershed, there is a potential that project operation may affect flow in Cascade Creek and subsequently the visual characteristics of these water features.

STUDY AREA

Areas within the study boundary will include potentially affected recreation areas within Swan Lake, Falls Lake, Cascade Creek and Thomas Bay. Also included are viewsheds that may be potentially affected during construction and upon completion of the Project. These areas include Swan Lake, the Cascade Creek Trail and falls, the southeast arm of Thomas Bay, and transition zones from subsea to above ground transmission lines.

STUDY SCOPE

The study scope will include the following elements:

Goal 1: Identify Recreational Resources

Recreational resources in the study area will be identified, inventoried and evaluated through a desktop analysis based on GIS-based and hard-copy resource maps; USFS, public agency and private service provider information; USFS, agency, and tourism websites; and other appropriate data sources. The study will also identify the recreation opportunities provided by these resources and how they vary seasonally. Given the remote nature of the study area, CCLLC proposes to focus on-site surveys to known points of access and temporary use.

Specific known recreation sites to be reviewed will include (Figure 1):

- Swan Lake Cabin
- Falls Lake Shelter
- Cascade Creek Trail
- Cascade Creek Cabin
- Spurt Cove Cabin

Recreation opportunities provided by Swan Lake, Falls Lake, Cascade Creek, and Thomas Bay will be identified using information from USFS and other agencies, guide and outfitter publications and interviews, and site observations of the study area, as necessary.

Figure 1. US Forest Service Cabins in the Study Area

CCLLC will also identify potential recreation facilities/access (such as installation of a new dock on Thomas Bay) and alternatives that the proposed Project may provide.

Goal 2: Evaluate Existing Public Use

Recreational opportunities provided by the facilities identified above are likely to include but are not limited to:

- scenic touring via private or chartered boats and kayaks or air charter;
- hiking and climbing;
- hunting, fishing, trapping and shellfish gathering;
- camping and cabin use;
- boating, kayaking/canoeing, diving and other water-related activities;
- mountain biking;
- on- and off-road vehicle uses, where permitted; and
- skiing, snowboarding and other winter activities.

Recreational use will be categorized by activity and quantified on a monthly basis. User groups for which use will be estimated include guides/outfitter customers, cruise ship

passengers, air charter tour passengers, and non-commercial recreational users. The percentage of users who are residents of the Petersburg area and non-residents will be estimated from survey data.

Several data sources will be used to provide information on use of existing recreation facilities and areas in the project vicinity:

- USFS Data - data from 2006 - 2010 will be compiled for USFS facilities including the Swan Lake Cabin, Cascade Creek Cabin, Spurt Cove Cabin, and Falls Lake Shelter.
- Outfitter Surveys/Interviews - cruise-ship and charter boat tour companies, air charter tour companies, and outfitter/guide companies operating in proximity to the Project, including those utilizing view-sheds in the project area, will be surveyed by mail or interviewed by phone to ascertain the number of visitors on a monthly basis and the length and frequency of trips to the area. See Appendix B for a list of Outfitter Companies to be included in the mail surveys/phone interviews.
- Resident Boater/Float Plane Surveys – local residents with boats or float planes registered in Petersburg, Wrangell, and Kake will be sent a mail survey soliciting information on monthly use of project vicinity recreation areas and opinions and preferences.
- Trail-cam Counts – Trail counters will be set up in the vicinity of the Cascade Creek waterfall to record trail users.

Future recreation demand analysis will utilize demographic trends to estimate future recreation demand within the area of project effect (APE) annually in 10 year increments, over the course of the anticipated 50 year license. Survey data, with respect to opinions of future use in the post-construction environment will provide additional information to estimate the Project's potential effect on projected recreational use growth.

Specific information regarding the distribution, collection and analysis of survey and count data are discussed in greater detail in *Methodology* below.

Goal 3: Identify User Preferences and Opinions of Recreational and Visual Resources

Recreation

As discussed above, two surveys (Outfitter Survey/Interview and Resident Boater/Float Plane Survey) will be administered to users and recreation providers to seek opinions and preferences with respect to existing recreation opportunities and potential future effects of project construction and operation on these opportunities. CCLLC will administer surveys to collect user characteristics (origin, gender, age, group size, etc.), primary recreation activity, recreation site(s) visited, length of stay, perceptions of crowdedness, recreation and visual qualities of the area, expenditures, opinions of constructed facilities

on the recreation experience, and other relevant information. A discussion of the survey question goals and methods are provided below in *Methodology*.

Aesthetics

While CCLLC will include an analysis specific to visual effects in its licensing documents that employs guidelines and methodologies provided by the Tongass National Forest Plan, the correlation between scenic beauty and the recreational experiences offered by the Thomas Bay area make visual resources an important part of the recreational opportunities available in the project area. CCLLC will administer the two surveys discussed above to determine: the perceived scenic beauty of the APE; the proposed Project's effect on perceived scenic beauty; what role scenic beauty plays in the recreational experience at the project area; and potential mitigation strategies. A discussion of the survey question goals and methods are provided below in Methodology.

Goal 4: Identify Potential Project Effects to Recreational Use and Aesthetics

Through the various count methodologies (existing USFS data and trail cam counts) and the survey administration, the study will evaluate:

- Potential impacts to the recreational experience and to recreation use patterns due to light, noise, increased human use during construction, and visual disturbances.
- The anticipated impact of the construction phase of the Project as a deterrent to recreational use in the project area.
- The anticipated impact of the permanent presence of project facilities as a deterrent to recreational use in the project area.
- The anticipated impact of the construction phase of the Project on the visual characteristic of the project area.
- The anticipated impact of the permanent presence of project facilities on aesthetics in the project area.
- Potential impacts to other resources such as changes to wildlife and fish populations could affect the recreation experience.
- Analysis of existing, regional recreational expenditures to include a qualitative analysis of potential use affects.

Primarily, the potential project impact analysis will depend upon data from surveys, follow up interviews as needed, and available data from existing sources. This study will also analyze the project features, function and operations for compliance with the purpose and intent of each of the individual Forest Plan Land Use Designation (LUD's) that may apply to the project boundaries. Identified LUD's in the APE are: Semi-Remote Recreation, Old Growth Habitat, Modified Landscape, Scenic Viewshed and TUS (transportation and utility corridor).

CCLLC will then address identified effects in the final report for the recreation study. CCLLC will identify potential mitigation strategies to reduce project impacts on recreational users in consultation with Stakeholders. These strategies may include:

avoidance; detour; scale and timing minimization; protection, mitigation and enhancement measures to offset the loss of recreation opportunities; and alternative use opportunities for both the construction phase and the life of the Project.

STUDY METHODOLOGY

Literature Review and Data Search

To address the data needs for Goal 1 and Goal 2 of the study (recreation inventory and use), researchers will conduct a literature review and data search to develop a complete list of recreational resources within the general vicinity and project area and to collect existing information on recreational use of these resources. Primary sources will include, but not be limited to:

- USFS Tongass Forest Plan & Amendment
- USFS Petersburg District Ranger Station Records
- USGS maps and existing GIS data
- Tourism and recreational atlases, brochures, guidebooks, and websites
- Commercial recreation advertisements and websites
- Alaska Department of Fish and Game (ADFG) harvest records for fish & game in the project area.
- USFS Recreation Facility Master Plan
- USFS Tongass National Forest website.

As discussed above, Swan Lake Cabin, Spurt Cove Cabin, Falls Lake Shelter and Cascade Creek Cabin use estimates will be based on records and reservations kept through the USFS.

Surveys and Interviews

To address the data needs for Goal 1 (recreation inventory), Goal 2 (recreation use), Goal 3 (user preferences and perceptions), and Goal 4 (project effects to recreation and aesthetics), researchers will conduct a series of surveys and, as necessary follow up telephone interviews with recreation providers and recreation users.

The USFS Petersburg Ranger District, ADFG, private cruise-ship, charter service companies, and tourism service providers may all provide use records and anecdotal information regarding existing use of the recreation areas in the project vicinity as well as expenditures, and preferences and opinions regarding existing facilities and the potential effects of project construction and operation on recreational use and aesthetics. In addition, residential users who boat or fish in the project area may provide information regarding use levels, recreation activity seasons, and opinions on the effects of project construction and operation on the recreation experience and visual quality of the project area. To that end, an Outfitter Survey/Interview and a Resident Boater/Float Plane Survey will be administered to determine:

- the location, timing, level and type of recreational uses taking place in the project vicinity;
- existing recreation facilities and opportunities in the vicinity of the Project;
- the potential project construction and operation impacts on recreational use;
- the visual resources in the project area as identified by users and opinions of project effects on these resources; and
- expenditures of recreational users in the project area.

Outfitter Survey/Interview

CCLLC will administer these surveys either as a mail survey or as a phone interview, depending upon the preference of the recreation service provider. The survey/interview will solicit information on:

1) number and duration of trips to the project area;
2) specific facilities or features targeted for commercial trips;
3) total number of people participating in trips to the project area by month;
4) revenue received from people participating in trips to the project area;
5) opinions on potential effects to recreational use of the project area by project construction and operations;
6) opinions on potential effects to the aesthetics of the project area by project construction and operations; and
7) company information such as location and years in business.

As the information solicited above would be considered proprietary, overall use estimates will not be broken down by outfitter. No information collected through these interviews will be published. Summary data will be reported with no identifying information.

The surveys/interviews will be administered in fall of 2010 to solicit information regarding the 2009 winter, 2010 spring, 2010 summer (peak recreation), and 2010 seasons.

Resident Boater/Float Plane Survey

These surveys will be administered as a mail survey. Specifically, CCLLC will obtain a mailing list of registered boats and float planes in the Petersburg, Wrangell and Kake areas and distribute the survey to these registered boaters and pilots. The survey will include a cover letter with instructions to complete the form and mail it back in the provided self-addressed, postage-paid envelope. . The surveys will solicit information on:

1) group size;
2) length of trip and length of stay in the project vicinity;
3) primary and secondary recreation activities;
4) location/area of trip;
5) scenic attributes and detriments;
6) quality of recreation areas/facilities;

7) expenditures; and
8) demographic information such as residence, age, and income.

Site specific impact questions will address:

- altered water flow in Cascade Creek,
- affects to Swan Lake and Falls Lake levels,
- potential new recreation facilities provided by proposed project alternatives such as the development of a new dock/ Thomas Bay access visual disturbances in viewsheds including Thomas Bay, Swan Lake, Falls Lake, Cascade Creek, Frederick Sound, and by project facilities and appurtenant features (power line transition zones)
- any alterations to current public access.

A photo-base of viewsheds will be compiled, and graphic renderings of proposed project facilities will be developed to present an accurate depiction of the visual setting pre-construction and post-construction for users to evaluate in the survey.

Field Monitoring

Trail Cams

To augment overnight use data provided by the USFS and to capture dispersed private use of the Cascade Creek trail, CCLLC is installing photographic trail use counters at the primary lower falls viewing area at the outlet of Cascade Creek and a second, approximately 1000ft past and upstream of the footbridge above the falls.

Post License Compliance Monitoring

Section 8.11 of the FERC regulations require that Licensees prepare a Licensed Hydropower Development Recreation Report (Form 80) for each hydroelectric development every six years. The Form 80 is divided into two sections, referred to as Schedules 1 and 2, respectively. Schedule 1 includes basic Project and overall public use information, including an estimate of annual recreation days[1], in terms of both annual total and peak weekend[2] average and for daytime and nighttime use. Schedule 2 requests an inventory of recreation resources for the Project, and an estimate of the percent capacity at which sites are currently used. The purpose of completing the Form 80 is to provide sufficient information for FERC regarding recreational facilities located at the Project, whether public needs are being accommodated by the facilities, and whether additional efforts should be made to meet future needs.

[1] FERC defines recreation day as each visit by a person to a development (as defined above) for recreational purposes during any portion of a 24-hour period.
[2] FERC defines peak weekend use as weekend when recreational use is at its peak for the season (July 4 weekend and other holiday weekends). On these weekends, recreational use may exceed the capacity of the area to handle such use.

Once the Project is licensed and constructed, CCLLC will continue to review recreation use, opportunities, and needs under FERC's Form 80 Recreation Use Report requirements every six years. Concurrent with the filing of the Form 80, CCLLC will provide a Recreation Use Report detailing the methodology for use data collection and analysis; an inventory and condition summary of existing recreation sites within the project area; recreation use of existing facilities and an assessment of the capacity at which facilities are used; and a discussion of the Project's ability to meet current and projected future recreational demand. The information provided by this Report will be used to assist both CCLLC and agencies/stakeholders in developing future recommendations for recreation opportunities. To this end, CCLLC will continue to review recreation use and access needs as part of periodic reporting and will coordinate with appropriate agencies in the provision of future recreation sites or improvements, as necessary.

CCLLC intends to incorporate periodic (every five to six years) aerial counts at both Swan Lake and Thomas Bay from the northern end of Ruth Island to the southern terminus of the bay during the peak recreation season, Memorial Day to Labor Day weekend as part of a post filing recreation monitoring program. The aerial counts will be conducted on a total of 15 days over the study period: six weekdays, six weekend days, and one day each of the three holidays (Memorial Day, Independence Day, and Labor Day). Each waterbody will be divided into several segments on use count maps. The starting location (Swan Lake or Thomas Bay) and the direction for each count (travelling north or travelling south) will be randomly selected for each count.

Recreation activities that occur on the water for both waterbodies will be recorded on the count maps as close to the actual locations of the activities as possible. This information will then be transferred to an aerial count sheets and separated by activity. Any stationary boats will be designated as "fishing." All others boats will be recorded by their respective boat type/recreation category (Powerboat, Sailboat, Cruise Ship, Commercial Fishing Vessel, Canoe/Kayak, Personal Water Craft, Other).

The trail cam counters will be left in place through the 2011 recreation season to provide a check and validation of day use estimates calculated for 2009 – 2010.

Consistency with Generally Accepted Practices

The trail counts, and mail surveys, and interviews will be carried out in accordance with the methodology outlined in *Angler Survey Methods and Their Applications in Fisheries Management* (Pollock et. al., 1994), *Mail and Internet Surveys: the Tailored Design Method* (Dillman, 2000) and *Survey Research Methods* (Fowler, 2000) and in consultation with the USFS and ADFG.

SCHEDULE

Initial data collection for the recreation study began in May 2010. The full study plan will proceed as soon as the final study plan is approved by the agencies. CCLLC intends to administer Outfitter and Resident Boater/Float Plane surveys in early fall 2010. Trail cameras will be installed in early fall 2010.

Literature Search. Will continue throughout the study duration.

Interviews and Surveys. Outfitter Surveys/Interviews and Resident Boater/Float Plane Survey will begin as soon as the study plan is approved, with a target completion data of November 1, 2010.

Field Monitoring. Incidental field monitoring is currently part of all other studies occurring at the project now. Field monitoring of trail use with trails cams will begin as soon as the study plan is approved and continue through September, 2011, as a means of use estimate validation.

REPORTING

A progress report discussing preliminary data will be distributed at the end of October 2010. This report will include initial observations, conclusions, and recommendations that will be incorporated into the NEPA licensing documents.

In addition to outlining the methods and results of the study, the final report will include a general discussions of resources present, timing and utilization, as they relate to other areas in Southeast Alaska, and to any previous data collected in project area. More intensive interpretation of these will be included in additional information reports to support NEPA documents and will provide recommendations to avoid impacts, enhance recreational use opportunities, or provide mitigation for project impacts as recreational study findings conclude. As appropriate, the final report may address proposed changes in project operation, or effects of mitigation proposals which arise during the licensing process.

Collected and analyzed data will be provided as an appendix to and included within the text of the license application. This information is anticipated to include an annual evaluation of commercial use from the results of the Outfitter Survey/Interview, an annual evaluation of boating use from the results of the Resident Boater/Float Plane Survey, and an annual evaluation of overnight use from the USFS.

MEETINGS

An initial discussion occurred as part of a broader agency study plan meeting on August 12, 2010, to finalize study details and methodology. The objective of the discussion was to finalize the study approach and make any revisions necessary to address the needs of

the participating agencies. After the meeting, CCLLC provided draft meeting minutes for review, and, following finalization of the minutes incorporated revisions to the plan as directed at the meeting.

CCLLC subsequently met with FERC staff to discuss the applicability and acceptability of its proposed recreation study plan and FERC's timeline for receipt of information. This discussion resulted in subsequent revisions to the proposed plan as presented herein.

CCLLC will hold a meeting in late fall 2010 to review the progress report and initial study findings and to solicit any agency feedback for improving the methodology such as obtaining better return rates on surveys. After the meeting, CCLLC will provide draft meeting minutes for review, and, following finalization of the minutes, modify study implementation accordingly, as necessary.

Additional meetings will be held as necessary to update the study progress and review preliminary results.

RELEVANT RESOURCE MANAGEMENT GOALS

The USFS and ADFG are both charged with the protection of recreation, aesthetics, fisheries and wildlife resources in the project area. To that end, the USFS Tongass Forest Plan & Amendment, USFS Recreation Facility Master Plan, the ADFG Recreational Boating and Angler Access Program, and other management plans will be consulted in the preparation of a Recreation Report for the proposed Project, as appropriate.

FINAL WILDLIFE STUDY PLAN

Cascade Creek Hydroelectric Project (FERC No. 12495-002)

Cascade Creek LLC

September 2010

Table of Contents

1. INTRODUCTION

In February, 2008, Cascade Creek Limited Liability Corporation ("CCLLC") received a Preliminary Permit ("Permit") from the Federal Energy Regulatory Commission (FERC) for the Cascade Creek hydroelectric Project (FERC No. 12495-002, "Project"). The proposed Project would be located approximately 15 miles N.E. of Petersburg, Alaska, and may involve effects to resources associated with Swan Lake, Falls Lake, Cascade Creek, Thomas Bay, and Frederick Sound.

2. BACKGROUND

Generally, the Project would consist of construction and operation of an intake structure and an outlet control structure at Swan Lake; a power conduit consisting of a mostly unlined 12 foot diameter tunnel; and a steel penstock leading to a powerhouse located at tidewater on Thomas Bay. Installed capacity of the Project would be approximately 70 megawatts (MW). The current run of the river operational proposal would draw water from Swan Lake at a rate congruent with inflow in a manner that maintains natural lake level fluctuations. A subsea and overhead transmission line will be installed to transmit generated power from the Project site to a substation located near Petersburg.

During initial consultation and scoping, Project stakeholders including state and federal resource agencies indicated concern for Project effects on wildlife resources within the project area and close proximity. A Draft Wildlife Study Plan was prepared to address these concerns, as related to Scoping Document 1. More recently, Scoping Document 2 has been prepared and is being issued simultaneously with this Final Wildlife Study Plan. This Final Wildlife Study Plan reflects comments from stakeholder review of the Draft Wildlife Study Plan and stakeholder coordination through the development of Scoping Document 2.

3. OVERALL STUDY SCOPE

3.1 *Goals and Objectives*

This study plan is designed to provide pre-development baseline data on terrestrial resources in areas potentially affected by the Project. This data would be used as part of a separate process and document to examine potential effects of hydro development associated with run-of-the-river operations of the proposed Cascade Creek Hydroelectric Project.

Evaluations of effects to federally listed threatened and endangered wildlife pursuant to the Endangered Species Act (ESA) and sensitive species listed by the U.S. Forest Service (USFS) will be evaluated in a separate document, the Biological Assessment/Evaluation.

3.2 Resource Management Goals

This study plan will provide baseline information to agencies with jurisdiction over wildlife resources allowing them to address potential project effects. This information will assist agencies in identifying appropriate Protection, Mitigation and Enhancement measures (PM&Es) for the

Project license according to their respective management goals. The following summarizes the various agencies that have provided commentary and feedback on the Project to date.

The project occurs on lands administered by the USFS, specifically, the Tongass National Forest. The Tongass National Forest administers their resources guided by the National Forest Management Act (NFMA), which is the chief statute governing the administration of national forests. The NFMA requires the Tongass National Forest to evaluate their lands and build a management program based on multiple-use and sustained-yield principles. This management program, entitled The Tongass Land and Resource Management Plan (TMLP) functions as a guide for management activities as well as institutes management standards for the Tongass National Forest. Within the TMLP, management plans are outlined for Forest service designated species, which include Management Indicator Species (MIS) and Forest Service Sensitive Species. MIS represent species whose response to land management activities can be used to predict the probable response of other taxa with similar habitat requisites. MIS are selected because their population level changes are thought to indicate the effects of management activities. Sensitive species are so designated because their population viability is a concern on the Tongass National Forest. These populations or the population's habitat exhibits or are predicted to exhibit a significant downward trend. The goal of the Forest Service Sensitive Species Program is to prevent federal listing under the ESA.

Terrestrial wildlife and freshwater fish resources are administered by the U.S. Fish and Wildlife Service (USFWS). The mission of USFWS is to "conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people." In doing so, USFWS enforces wildlife laws, protects endangered species, manages migratory birds, and helps to restore important fisheries. They administer the ESA, designed to protect imperiled species from going extinct. Species are added to the ESA by either a candidate assessment process, where agency officials identify candidates; or a petition process, where any interested party can petition the Secretary of the Interior to add a candidate. USFWS also administers the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). The MBTA prevents the "take" of migratory birds. A bird is considered migratory under the MGTA if it spends any part of its lifecycle across an international border. The BGEPA offers even further protection for bald and golden eagles.

The Alaska Department of Fish and Game (ADFG) seeks to provide the public the opportunity to utilize the state's fish and wildlife, ensure the sustainability of the resources, supply information about and involve the public in management of the resources, while protecting the state of Alaska's sovereignty to manage these resources. He ADFG identifies Species of Special Concern, which are defined as "any species or subspecies of fish or wildlife or population of mammal or bird native to Alaska that has entered a long-term decline in abundance or is vulnerable to a significant decline due to low numbers, restricted distribution, dependence on limited habitat resources, or sensitivity to environmental disturbance." The ADFG provides for recovery efforts for taxa designated a Species of Special Concern, mitigates significant threats to those species and attempts to identify the species before federal listing becomes necessary.

While FERC is the lead agency for the National Environmental Policy (NEPA) document for this project, the Environmental Protection Agency (EPA) is the overall agency responsible for

administering and assuring adequacy of the NEPA process holistically, and is directed by the Clean Air Act to oversee environmental projects associated with major federal activities. Effects to wildlife must be considered as part of the NEPA process.

The Alaska Natural Heritage Program (AKNHP) is a clearinghouse for information on Alaskan species of conservation concern. AKNHP "collects, validates, and distributes this information, and assists natural resource managers and others in applying it effectively."

4. PROJECT DESCRIPTION

The current description of the project, including both transmission line alternatives being considered under the NEPA is detailed in Scoping Document 2.

5. STUDY AREA

Wildlife studies will be conducted at various levels of intensity within the project area depending on the anticipated impacts on wildlife and their habitat. Study areas described in the following plan will be referenced relative to:

Upper Cascade Creek

- This study area comprises the portion of Cascade Creek that flows from a natural fish barrier, approximately 1 mile upstream of Swan Lake, and drains into Swan Lake. The area also encompasses Spring Creek running parallel to Upper Cascade Creek for approximately 1 mile upstream of Swan Lake.

Swan Lake

- This study area encompasses Swan Lake and its immediate surroundings and includes the intake for the tunnel system and any temporary staging or storage areas during project construction on the shoreline of Swan Lake.

Lower Cascade Creek Corridor

- This includes Cascade Creek between the Swan Lake outlet and the Falls Lake inlet, and from Falls Lake inlet along Cascade Creek to its discharge in Thomas Bay. This area also includes Falls Lake and the Pond area between Falls Lake and Swan Lake.

Project Powerhouse and Tunnel

- The tunnel. This portion of the project lies between the intake at Swan Lake, continuing 13,100 feet in two horizontal and one vertical section in a southwesterly direction to the powerhouse site, and is entirely underground.
- The powerhouse site. This includes the area between the point in which the tunnel daylights, shaft, penstock, 8-acre powerhouse pad, tailrace, and any temporary staging and storage areas during construction.

Transmission Line Routes

- Thomas Bay Subsea Transmission Line. This includes the subsea transmission line between the powerhouse site and the overhead transmission connection on the eastern shore of Point Agassiz Peninsula.
- Point Agassiz Overhead Transmission Line. This includes the overhead transmission line and access corridor from the shore of Thomas Bay, southwest approximately 6 miles to the subsea initiation at Frederick Sound just north of Agassiz South Base.
- Frederick Sound Subsea Transmission Line. This includes the section initiating at the point where the overhead transmission line becomes subsea from the western shores of Point Agassiz Peninsula and crosses Frederick Sound southwest to the eastern shores of Mitkof Island.
- Petersburg Overhead Transmission Line. This includes the point at which the Frederick Sound Subsea Transmission Line connects to the eastern shores of Mitkof Island approximately 1 mile south of Petersburg, and continues over land to the substation.

6. POTENTIAL NEXUS BETWEEN OPERATIONS AND EFFECTS

Based on generalizations of the project description in Scoping Document 2, effects of proposed project construction and operations may be derived from disturbance and habitat modification along transmission corridors and in facility infrastructure areas. Likewise, the EPA provided comment requesting evaluation of the potential effects on wildlife habitat from destruction, alteration, and habitat fragmentation caused by roads, transmission corridors, and other management and human activities. The USFS also expressed concern that there may be temporary habitat loss associated with the project, and additional information may be needed for those wildlife species that occur in the project area. Species-specific project nexuses are discussed in the respective "Study Objectives" section for each species.

7. STUDY ELEMENTS

The Wildlife Study Plan includes the following elements:

- A detailed literature search to gather existing data and information on all wildlife resources in the area;

- Field surveys to note presence, relative abundance, life history and habitat descriptions and use of wildlife species in the project area;

- Habitat and vegetation map resulting from on-the-ground field surveys, above, combined with aerial surveys and existing vegetation mapping.

7.1 *Literature Search*

A literature review will be conducted to develop a complete list of wildlife species known and with potential to occur in the Project area. Primary sources will include, but not be limited to:

- USFS Tongass National Forest survey and planning reports noting any sensitive species, species of special concern, or indicator species;
- ADFG periodic wildlife surveys, harvest records for big game, wildfowl, trapping and other activities, and records of subsistence uses and takes in the overall area;
- USFWS for information on federally-listed threatened, endangered or candidate species;
- AKNHP listings for important and sensitive species;
- Academic libraries of the University of Alaska and its affiliates in southeast Alaska, as well the Environment and Natural Resources Institute, Anchorage; and
- Cultural Resources researchers to assure inclusion of tribal knowledge of distribution, importance and use of wildlife species in the affected area.

7.2 Terrestrial Wildlife Studies

7.2.1 Sitka Black-tailed Deer

Overview

The Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) is endemic to Alaska and is the state's only native deer. This species is found in Southeast Alaska and northwest British Columbia. This species of deer has been found on nearly all islands within the Alexander Archipelago where the climate is less severe than those of mainland Alaska. Accordingly, deer populations tend to be denser on the islands of Southeast Alaska than on the mainland (Schoen, J. and Dovichin, 2007). This deer is considered a MIS to the USFS.

The Sitka black-tailed deer is of significance to the Project because this species is used more than any other terrestrial species in Southeast Alaska for hunting and subsistence. In addition, this species is an important food source for wolves and black bears. Sitka black-tails largely favor old-growth forests (USFS 2008). Changes to land cover type resulting from overland transmission line development could affect populations in the project area.

Life History and Habitat

Sitka black-tails use a variety of habitats throughout the year from coastal beaches to alpine areas, but tend to favor old-growth forests throughout the year. Old growth is important during the winter, as well, because of snow interception provided by the canopy and the abundance of understory forage common in these forests. The Sitka black-tail is generally found at elevations below 800 feet during winter months due to deep snow cover at higher elevations. During summer months, the range of the Sitka black-tail is largest as this species will move up in elevation and may be found in alpine meadows above tree line. Spring and summer habitats are vital to the recovery of this species because severe winters may cause deer to be severely malnourished (Schoen, J. and Dovichin, 2007).

During springtime the range of the Sitka black-tail increases as the snow melts and edible plants emerge at higher elevations. In late-May and early-June fawns are born, generally between sea level and 1,500 feet elevation. Migration of this species continues upwards in June as the snow continues to melt, and by late-June or early July, black-tails may occupy subalpine meadows of elevations up to 3,000 feet that contain abundant herbaceous forage among patchily distributed Sitka spruce (*Picea sitchensis*) and mountain hemlock (*Tsuga mertensiana*). Downward

migration generally begins in September with the first frosts and the desiccation of high-country forage plants (Schoen, J. and Dovichin, 2007).

The rut, or breeding season, begins in late-October and continues through the end of November. Deer are distributed between sea level and 1,500 feet in elevation during this time and occupy old-growth, forest openings and muskeg. From December through March, Sitka black-tails are generally confined to limited areas within old-growth forests that remain largely free of snow and provide forage throughout the winter months. Upward movement of this species is largely dictated by snow levels during the winters. Mature hemlock spruce forests provide Sitka black-tails with the best habitat during severe winters (Schoen, J. and Dovichin, 2007).

Study Objectives

The purpose of this study is to assess the relative quality and availability of winter range habitat in the Cascade Creek project area. This information will be used to establish a baseline for future monitoring of Sitka black-tailed deer winter range.

Methodology

Deer Winter Range Assessment

Suitable winter range habitat will be evaluated using methodology that was originally developed by Kirchhoff and Hanley specifically for deer in Southeast Alaska known as the "Quick-Cruise Method". This methodology provides an efficient and standardized evaluation of habitat for big game winter range habitat, based on the characteristics described in the *Life History and Habitat* section above (Kirchhoff and Hanley, 1992).

The Quick-Cruise Method allows biologists to quantify variables affecting habitat quality such as forage composition and quality, topography, and snow cover. Quality of habitat is quantified using a simple scoring method that assigns highest value to the most suitable winter range habitat for deer. Generally speaking, suitable winter range habitat for Sitka black-tailed deer is characterized by abundant and nutritious forage, minimal snow cover, nearby permanent unfrozen waters, flatter ground, slope aspects that are more likely to remain free of snow (Kirchhoff and Hanley, 1992).

The specific methodology, evaluation criterion, and scoring methods are outlined in the *Deer Winter Range Stand Exam Form* developed by Kirchhoff and Hanley, 1992, which is included in Appendix A. Correspondingly, winter range habitat criterion includes:

Forage (50% of total score)

- Shrubs (Blueberry)
- Forbs (Bunchberry/Goldthread/5 leaf Bramble)
- Nutritional Quality (Overstory canopy cover; shaded areas indicate higher nutritional value)
- High Value Species within 100' of Plot Center (Huckleberry/Skunk Cabbage/Shield Fern)

Snow Conditions (50% of total score)

- Snowfall

- Elevation
- Distance from Coast
- Snow Interception
- Snow Melt (Evaluation of slope and aspect)
- Shading (Angle to horizon)

For each stand, the observer will fill in all fields contained in the exam form such as stand number, observer(s), date, etc. In addition, the presence or absence of deer, abundance of pellet groups, evidence of bedding, trails, condition of vegetation, snowdrifts, and animal scat, etc. will be noted (Kirchhoff and Hanley, 1992).

Previously harvested areas do not provide high-quality winter forage for deer; therefore a stratified approach will be used to identify all productive old-growth (POG) stands within 500 feet of the proposed overland transmission line on Agassiz Peninsula. These POG stands will be overlaid with a random grid of sampling points spaced 450 feet apart utilizing Geographical Information System (GIS) software. Additionally, three sampling points will be located in the vicinity of the powerhouse site. All completed sampling points will be averaged by POG stand to provide a baseline of overall quality of winter range habitat. At points located along POG stand edges, field staff will move into the interior of the stand to an area more accurately representative of the stand as a whole. Locations of the survey points will be identified in the field by GPS.

Although this field method does assess snow conditions, it is not a requirement that data is collected during winter months because the snow conditions criterion are based on geographical features such as shading and elevation rather than analysis of the actual snowpack in the area (Kirchhoff and Hanley, 1992).

Work Product

The work product will be a report summarizing the data collected from all winter range habitat assessments. The final report will include maps delineating winter range habitat and locations of all surveys, and recorded observations. Photographs of winter range habitat may also be included.

7.2.2 Small Mammals

Overview

Southeast Alaska is home to a large number of small mammal species that largely fall into the following categories of taxa: shrews, rodents, pikas, mustelids, and hares. Many of the species within these taxa are endemic and exist in isolated populations due to the naturally fragmented landscapes common to this part of the state. The fragmented landscapes include the Alexander Archipelago islands and narrow corridors or "bottlenecks" of habitat that result from the complex glacial history in the region.

This study focuses on "endemic species," which are defined by the USFWS as a species native and confined to a certain region and having comparatively restricted distribution. The 2008 Tongass Forest Plan further emphasizes endemic studies to include endemic terrestrial mammals

with a focus on small (voles, mice, and shrews) and medium-sized (ermine and squirrels) endemic mammals with limited dispersal capabilities.

Endemics are generally more vulnerable than non-endemics to natural or human-caused disturbances because of their limited geographic extent. In addition, small mammals are an important source of food for predators in the area (USFS 2008). The Cascade Creek project has the potential to affect local small mammal populations through surface disturbances resulting from the development of overhead transmission lines, powerhouse site, penstock, access roads and outbuildings. Small mammals have been included in this wildlife study plan for these reasons and based on comments made by the ADFG that the temporary loss of habitat from development activities is of concern.

Life History and Habitat

Small mammals in southeast Alaska have not been studied to the extent of larger mammals and other species of concern in the region. For this reason, knowledge of distribution and population of small mammal communities in the area are patchy at best. However, species that have been documented within one hundred miles of the Cascade Creek project site include the flying squirrel (*Glaucomys sabrinas)*, hoary marmot *(Marmota caligata)*, red squirrel *(Tamiasciurus hudsonicus)*, American beaver *(Castor canadensis)*, western jumping mouse *(Zapus princeps)*, long-tailed vole *(Microtus longicaudus)*, meadow vole *(Microtus pennsylvanicus)*, southern red-backed vole *(Clethrionomys gapperi)*, northern red-backed vole *(Myodes rutilus)*, common muskrat *(Ondatra zibethicus)*, northwestern deermouse *(Peromyscus keeni)*, northern bog lemming *(Synaptomys borealis)*, cinereus shrew *(Sorex cinereus)*, dusky shrew *(Sorex monticolus)*, American water shrew *(Sorex palustris)*, ermine *(Mustela ermine)*, marten (*Martes americana*), and the American mink *(Neovision vision)* (MacDonald and Cook 2007). Of these species, the ermine and marten are designated Species of Conservation Concern (ADF&G 2006). There may, however, be additional undocumented sensitive species living in the study area.

Although many of these species have distinct habitat requirements, small mammals in southeast Alaska do share general preferences. Small mammals are almost always found in or near areas that provide adequate cover from weather such as tall grasses and shrubs. Other habitat features that are favorable for a wide variety of small mammals include logs, burrows and in areas at the bases of trees (Manly et. al. 2006). In southeast Alaska, diversity and populations of small mammals tend to be greatest in scrub and herbaceous habitats and lower in area of dense, closed canopy. Second growth stands that have abundant understory vegetation have been found to support high densities of small mammals (USFS 2008).

Specific food preferences vary among small mammals and a comprehensive description of specific food requirements for each of the small mammal species listed above is beyond the scope of this wildlife plan. However, brief descriptions for some of the species listed in this document are summarized below. Shrews tend to be opportunistic feeders that eat insects, spiders, beetles and on occasion, nesting rodents. Flying squirrels are omnivorous and feed on various insects, fungi, lichens, berries, seeds, green vegetation and will occasionally eat meat, young birds and eggs. Voles are primarily herbivores and tend to feed on a variety of grasses and sedges, but occasionally feed on eggs of ground-nesting birds (Alaska Natural Heritage Program 2010).

Study Objectives
The purpose of this study is to establish baseline data regarding which species of small mammals occur in and around the Cascade Creek Hydroelectric Project area.

Methodology
Small mammals will be surveyed using Sherman Live Traps. The sampling design used in this study is adapted from the methodology for small mammal trapping described in the USDA Forest Service Multiple Species Inventory and Monitoring (MSIM) Technical Guide (Manly et. al. 2006). The use of this MSIM technique and any adaptations to this methodology are summarized below, but the user is referred directly to the referenced methodology for a complete description of steps that will be taken in the field.

Small mammal surveys will be conducted using extra long (XLK model, 7.6 by 9.5 by 30.5 cm) and extra large (XLF15 model, 10.2 by 11.4 by 38cm) Sherman Live Traps throughout the study area supplemented with pitfall traps. This combination of traps should provide a more accurate description of small mammal community composition, as it allows for the sampling of the entire range of species that may be present in the study area. Transects will originate from 3 randomly selected stations along the transmission corridor and one transect placed at the powerhouse location. A transect method is appropriate for this wildlife study since it is more efficient than grid arrangements and because transect studies will adequately sample the long narrow transmission corridors. Transects will consist of 10 traps placed in a line centered at the point-count station, placed 20 meters apart (to accommodate average home-range size of most small mammals), and run perpendicular to the corridor trajectory. Traps will remain in place for three days in each survey area and checked at least twice daily.

All small mammal data will be recorded on the following form which is included in Appendix A:

- *Sherman Live Trapping Form*

Work Product
The work product will be a report that summarizes the data collected from all trapping activities. The report will describe relative species composition for small mammals in the area affected by the powerhouse and transmission line corridor. Maps will be included in the final report that includes locations of all surveys and recorded observations by species. Photographs of specimens may also be included in the final report.

7.2.3 Queen Charlotte Northern Goshawk

Overview
The Queen Charlotte subspecies of the northern goshawk is endemic to coastal forests from the northern portion of southeast Alaska to Vancouver Island in British Columbia, Canada. The goshawk is rated as a USFS Sensitive Species and a MIS on the Tongass National Forest, is included in the yellow category of Audubon WatchList 2010 (USFS 2008), and is designated an Alaska Species of Special Concern. The Queen Charlotte northern goshawk is believed by ADFG to inhabit the Thomas Bay area on a year-round basis. The northern goshawk has been included in this wildlife study plan due to the potential loss of nesting habitat and effects to

breeding, nesting, and foraging goshawks. The ADFG specifically requested inclusion of nest activity surveys for this species in the Wildlife Study Plan.

Life History and Habitat

The northern goshawk is present year-round in southeast Alaska, preferring mature and old-growth stands with an open understory for foraging and nesting. Goshawks often select larger trees within stands for nesting. An abundance of this type of habitat exists in the project area.

The "Conservation Assessment for the Northern Goshawk in Southeast Alaska" (Iverson et al. 1996) provides information on nesting chronology in the southeast panhandle region of Alaska,of which egg laying begins the second week of March to May 24; eggs hatch between May 12 and June 23; nestlings fledge between June 23 and August 4; and fledglings disperse from natal territories between August 2 and September 13. Goshawks may use the same nest for multiple years, build a new nest in the same or different stand, or reuse an old nest. Both males and females construct nests. In southeast Alaska, goshawk diet is largely comprised of a few key species: blue grouse spp., medium-sized birds (e.g. Steller's jay and varied thrush), and red squirrels (USFS 2008).

Large-scale industrial timber harvest has contributed to a decline of goshawks in the Pacific Northwest. Logging activities cause nests to be lost due to tree-cutting, produce nest abandonment and severely diminish appropriate nesting habitat (Squires et al. 1997)

Study Objectives

The purpose of this study is to assess presence/absence of the northern goshawk including nesting activity in and around the proposed Cascade Creek Hydroelectric Project.

Methodology

Northern goshawk surveys will be conducted using a modified protocol established by Kennedy and Stahlecker (1993) and further described in the 2006 U.S. Department of Agriculture Northern Goshawk Inventory and Monitoring Technical Guide, and modified in the Broadcast Acoustical Survey (BAS) methods adapted for projects in the Tongass National Forest (Stangl 2009).

Goshawk surveys will be conducted along the terrestrial portion of the transmission line corridor. Survey stations will be established 200 meters apart along a single transect the length of the transmission line corridor. Areas of 40 acres or less that may be developed, such as the powerhouse site, will be surveyed from a minimum of four locations at each boundary of the development area (north, south, east and west).

Broadcast Acoustical Surveys will be completed between June 1st and September 1 of 2010. Any documented nests will be visited and surveyed for activity, occupancy and determination of alternate nests in the area (Stangl 2009). A digital amplifier will be used at each call station to sound the juvenile begging or wail call. Broadcast calls will be made at an angle of sixty degrees for a period of ten seconds, followed by a 30 second listening and watching period. This sequence will be completed two more times at each station, approximately 120 degrees from the last broadcasts. A minimum of four minutes will be spent at each station. When time permits,

one minute will be spent watching and listening before broadcasting and up to five minutes will be spent watching and listening after the last call has been made. While travelling between stations, surveyors will listen and watch for responsive northern goshawks as well as any nests or sign. Broadcasting will take place in rainy and windy conditions only if the weather is not expected to interfere with broadcast results.

All data collected during northern goshawk surveys will be recorded on the following form, Appendix A:

- *Tongass NF Goshawk & Wildlife Survey Form*

Work Product
The work product will be a report that summarizes the data collected from all northern goshawk surveys, particularly nest locations and status. Maps will be included in the final report that include locations of all survey points, goshawk sightings and nest locations.

7.2.4 Amphibians

Overview
Alaska hosts a variety of amphibian species, of which wood frogs (*Rana sylvatica)* and western toads (*Bufo boreas)* are the most common and widespread. Southeast Alaska is considered the northernmost extreme of the range for all amphibian species found in the study area except for the woodfrog and the western toad. The red-legged frog (*Rana aurora)* and the pacific chorus frog *(Pseudacris regilla)* are listed as nonnative species (MacDonald 2003).

The Alaska Natural Heritage Program database reports occurrences of western toads and Columbia spotted frogs (*Rana luteiventris)* in the immediate vicinity of the Cascade Creek Hydroelectric Project area. Wood frogs, long-toed salamanders (*Ambystoma macrodactylum),* and roughskin newts (*Taricha granulosa)* have been reported within 30 miles of the project area. Other amphibians that also occur in Alaska but have not been observed within at least 100 miles of the project site include northwestern salamanders (*Ambystoma gracile),* pacific chorus frogs, red-legged frogs and the enigmatic Alaska worm salamander *(Batrachoseps caudatus)* (ADFG 2006).

Amphibians are often considered indicator organisms, meaning the relative health of amphibian populations can be used to track large-scale changes in environmental quality and ecosystem functions. These species serve well as bioindicators because amphibians have highly permeable skin and eggs, which makes them sensitive to toxins and changes in moisture and temperature conditions. Amphibians also occupy a key trophic role in both aquatic and terrestrial ecosystems functioning as consumers of invertebrates and as prey for larger animals (ADFG 2006).

Amphibian populations around the world are declining rapidly, however, research is lacking on amphibian populations in Alaska. Significant declines have been noted for the western toad within the state, but little is known about total populations or current trends of other amphibians that are found in the state. Loss and degradation of habitat are major factors for amphibian decline on a global level, but there are many unknowns as to why amphibian populations are declining so rapidly. Several fungal diseases, such as chytrid fungus, have been discovered

recently and pose major threats to amphibians worldwide. Chytrid fungus has been documented in Alaskan amphibians. Many scientists consider cumulative effects to be the major factor; i.e., the combination of habitat degradation and other environmental effects such as climate change, which are contributing to reduced amphibian populations globally. Other common sources of mortality for amphibians include increased UV-B radiation, predation from introduced fish and amphibian species and damage to immune systems from pesticides and other pollutants. Amphibian populations in Alaska appear to have higher rates of deformity than in most areas within the United States but reasons for this are not yet known (ADFG 2006, Woodford 2006).

In Alaska, amphibians are managed by Alaska Department of Fish and Game under statute 16.05.030, in which amphibians are legally included in the definition of "fish". This statute makes it illegal for anyone to "hold, transport or release" any native amphibians without a valid permit. The species occurring in the project vicinity are not currently listed as threatened or endangered under state or federal law, but the Columbia spotted frog is a candidate under the ESA. All species potentially occurring in the Cascade Creek project area are listed in Table 4 (MacDonald 2003).

Amphibians exhibit a high degree of site fidelity to breeding sites. For this reason, comprehensive field efforts will be completed to assess potential impacts to these areas resulting from dewatering or changes in water levels in Lower Cascade Creek, the Pond area and Falls Lake. Such field efforts are especially important because even relatively minor changes in water levels at these sites could greatly increase the likelihood of local population extinctions in the project area due to habitat degradation or loss. Although the total amount of suitable amphibian habitat in the project area is relatively small compared to the forested area, the assessment area comprises some of the only complex aquatic habitats in the vicinity. Therefore, amphibians in this area are potentially vulnerable to change because populations would be concentrated. In addition to their global and local sensitivity, amphibians have been included in this wildlife study plan based on comments made by USFWS to the Draft Wildlife Resources Study Plan.

Life History and Habitat

Although phenology of aquatic habitat use by amphibians within the Cascade Creek project area varies, these species are normally associated with freshwater during all or parts of the year. All amphibian species are associated with aquatic habitats during the breeding season and western toads and roughskin newts utilize upland terrestrial habitat outside of the breeding season. Aquatic habitat for these amphibians generally includes quiet waters such as backwaters, beaver ponds, marshes, springs, and slower sections of rivers and streams. Shallower waters are typically used for eggs and larval development. During the larval stage, amphibians filter feed on small, suspended aquatic invertebrates, plant material, or bottom detritus. After metamorphosis, amphibians feed on various small terrestrial and aquatic invertebrates (ADFG 2006, MacDonald 2003).

Except for the Columbia spotted frog, which is an aquatic obligate, migrations toward breeding grounds begin in early spring. Oviposition occurs from April to July, depending on the species, weather conditions and elevation. Exact timing of breeding for Alaskan amphibians is relatively unknown as compared to other amphibians in the United States. Breeding may occur later in the year due to the relatively higher elevation at Swan Lake than along lower Delta Creek. Hatching

takes between one week and several weeks, depending on the species. Larval development occurs during the summer and metamorphosed juveniles will migrate towards winter hibernacula beginning in the fall. Characteristics of winter hibernacula vary between different amphibian species but generally consists of various types of cracks and crevices such as those located beneath downed woody debris. Some juveniles will remain in the ponds during the first winter but will migrate to other winter hibernacula the following fall (MacDonald 2003).

Table 4. Amphibian species potentially occurring in the project area.

Species	Status	Occurrence	Habitat	State Trend
Northwestern Salamander (*Ambystoma gracile)*	ADFG, S3, ESA PS	Not Likely	Muskeg ponds, freshwater lakes	Very little information is known about this species, considered rare; only three specimens collected in Alaska
Long-toed Salamander *(Ambystoma macrodactylum)*	ADFG, S3	Likely	Broad range, sea level to mountainous	Unknown; relatively common throughout its range, generally threatened by introduction of nonnative fish species and habitat fragmentation due to development
Roughskin Newt *(Taricha granulose)*	ADFG, S4	Likely**	Forested freshwater bodies	Very little information is known about this species
Western Toad *(Bufo boreas)*	ADFG, S3S4, ESA PS	Likely	Broad range, sea level to mountainous	Formerly considered abundant and widespread in SE Alaska, sharp declines are being noted
Pacific Chorus Frog* *(Pseudacris regilla)*	SNR	Not Likely	Muskeg ponds, freshwater lakes	Remains confined to pond system where it was originally introduced
Wood Frog *(Rana sylvatica)*	ADFG, S5	Likely	Diverse vegetation, permanent or ephemeral waters	Overall population and trends are unknown, although expected to be stable or slightly declining. Recent high incidence of abnormalities reported in core of range is cause for concern. In many areas wood frogs are no longer present at historical breeding sites in Alaska.
Columbia Spotted Frog *(Rana luteiventris)*	ADFG, S2, BLM S, ESA PS	Likely	Highly aquatic, permanent waters	Population status is unknown, although suspected to be low.
Red-legged Frog* *(Rana aurora)*	SNR, ESA PS	Unlikely/ Unknown	Dense vegetation, permanent waters	This species has not yet been studied in Alaska
Alaska Worm Salamander *(Batrachoseps caudatus)*	SR	Unknown (Enigmatic)	Unknown	No confirmed observations of this species in Alaska in over 100 years, validity of original observations considered questionable

* Denotes an invasive species.
** Observed in study area during field reconnaissance in June, 2010
ADFG: Legally protected from taking

BLM S: Sensitive
ESA PS: Partial status, U.S. Endangered Species Act of 1973, as amended by the U.S. Fish and Wildlife Service and the U.S. National Marine Fisheries Service (as of October 2002)
S1: Critically Imperiled— Critically imperiled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.
S2: Imperiled—Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3: Vulnerable—Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4: Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5: Secure—Common, widespread, and abundant in the nation or state/province.
SNR: Unranked—National or subnational conservation status not yet assessed.
SR: Reported to occur.

Study Objectives

The purpose of this study is to assess potential amphibian species composition, particularly those that are sensitive, and to evaluate habitat suitability in the Project area. The results of this assessment will be used to develop PM&Es for amphibians.

Methodology

An intensive literature review will be conducted to determine which species could potentially occur in the Project area. The assessment of potential presence/absence will be based on records and anecdotal information on current and historical distribution; presence according to life cycle and phenology (i.e., breeding, migration, estivation etc.); observations during other field investigations related to the Project; and availability of suitable habitat in the Project area.

Additionally, all habitat potentially affected by the Project will be evaluated for amphibian suitability and mapped. Aerial imagery and topographic maps will be used, along with field reconnaissance to perform this evaluation.

The presence/absence assessment and habitat suitability map will be used to develop appropriate recommendations for construction and/or operational mitigation measures pertaining to amphibians.

Work Product

The work product will be a report that summarizes the above information along with an amphibian habitat suitability map, which will include delineations of amphibian habitat and locations of all incidental observations. If available, photographs of amphibian habitat and incidental observations will be included in the final report.

7.2.5 Wolverine

ADFG will be conducting these studies.

7.2.6 Moose

ADFG will be conducting these studies.

7.2.7 Mountain Goat

ADFG will be conducting these studies.

7.3 Habitat Map

The EPA expressed concern that the proposed project may have impacts on wildlife habitat and habitat connectivity, and that the NEPA document should describe the current quality and potential capacity of habitat as well as its use by wildlife on and near the proposed project area, and identify known wildlife corridors, migration routes, and areas of seasonal wildlife congregation.

Using a combination of aerial and ground photos, topographic and existing resource maps as a primary data source, researchers will survey and document habitat features including vegetation community composition, estimates of relative percent cover of dominant species (e.g. willow, alder, cottonwood, sedges, forbs, grasses) and seral stage. Aerial imagery will be ground-truthed in accessible areas. Significant habitat features such as slopes, springs, rock outcrops, caves, mineral licks, wetlands, snags, dens and related will be catalogued. These surveys will be closely coordinated with botanical resource specialists who will be surveying the same areas for detailed plant distribution and abundance.

8. SCHEDULE

Terrestrial wildlife studies will be conducted according to the schedule in Table 5.

Table 5. Terrestrial Wildlife Study Schedule

Activity	Time Frame
Sitka black-tailed deer winter range assessments	August 1 to September 30, 2010
Small mammal trapping	August 1 to September 30, 2010
Charlotte Queen northern goshawk surveys	June 1 to August 31, 2010

9. LEVEL OF EFFORT AND COST

CCLLC finalized an agreement with OASIS Environmental, Inc. (OASIS) in July 2010 and will utilize the services of OASIS to develop the Wildlife Study Plan and conduct related field and reporting activities. In addition, OASIS staff will serve as a liaison for CCLLC to lead the Wildlife Study Group meetings and associated reporting. Estimates for the level of effort and cost are to be determined.

10. REPORTING

These wildlife and habitat studies will be carried out until September 30, 2010. A progress report documenting the wildlife and habitat surveys will be distributed monthly to the Wildlife Study Group beginning in September 2010. The progress reports will summarize preliminary survey information on wildlife studies that occurred during the past month and an outlook on wildlife

studies that will occur in the coming month. Additionally, survey reports for each field study will be submitted to agency stakeholders by January 31, 2011. Survey reports will include the following information:

- **Methods.** The author(s) will describe observation methods, including sites, dates, observations recorded (wildlife numbers and species, weather, etc, as described above) identification keys used and other items.

- **Results.** Authors will describe the results of the surveys and other recorded data. Study area base maps will be used to the extent possible to identify wildlife locations from the surveys, noting habitat utilization and life history activities. Observations of sensitive species, including ESA-listed and -candidate species will be noted. Any initial reports of ESA-listed and -candidate species will prompt discussions with USFWS to determine if additional study effort is needed.

- **Discussion.** This section will be brief and limited to general discussions of species present, timing and habitat utilization, as they relate to other areas in Southeast Alaska, and to any previous data collected in the project area. More intensive interpretation of these data in terms of species importance, impacts and mitigation measures will be done as part of development of the relicensing NEPA documents.

- **Recommendations.** This section will focus on evaluation of previous studies and ways in which they might be improved. In successive months this section will be used to evaluate effectiveness of changes and the extent to which proposals have been achieved.

11. MEETINGS

An initial Wildlife Study Group meeting will be held on August 12, 2010 prior to the beginning of 2010 field work. This meeting will be part of an overall stakeholder meeting, to include agency, client, and researcher representatives for the Aquatic Resources Study Plan and possibly representatives for other study plans. The objective of the meeting will be to discuss the study approach and make any revisions necessary to address the needs of the participating agencies. After the meeting, CCLLC will provide draft meeting minutes for review, and, following finalization of the minutes and incorporation of revisions to the plans directed at the meeting, the Study Plan for the Wildlife for the Project will be adopted as final.

The Wildlife Study Group will meet on a quarterly basis to discuss the progress of the implementation of the Final Wildlife Study Plan, or any updates to the Revised Draft Wildlife Study Report. Meeting times and a draft agenda will be developed at the Wildlife Study Group meeting on August 12, 2010.

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APPENDIX A
Survey Forms and Protocols

DEER WINTER RANGE STAND EXAM FORM

Project Area: _____ Date: _____ Unit #: _____
Survey Team: _____
Survey Name: _____ GPS PT Name: _____

FORAGE (50% of total score)

(1) Shrubs (Vaccinium spp) (20 pts)
(a) Abundance within 6' plot - % Blueberry Cover
75 % 10
50-75 % 8
25-50 % 6
5-25 % 4
1-5 % 2
Absent 0
(b) Plant Height (Most twigs are)
< 4 feet 2
> 4 feet 1

(1) Total _____X_____=_____

8.1.1Blueberry Cover X Plant Height

(2) Forbes (Bunchberry/Goldthread/
5-leaf Bramble) (15 pts)
Abundance within 6' plot cover - % Cover
> 20 % 15
5-20 % 10
1-5 % 5
Absent 0

(2) Total _____

(3) Nutritional Quality (5 pts)
Over story canopy within 100'
> 40 % 5
< 40 % 0

(3) Total _____

(4-6) High Value Species within 100' (10 pts)

(4) Huckleberry (Vaccinium parvifolium)
Present 4
Absent 0
(4) Total _____
(5) Skunk Cabbage
Present 3
Absent 0
(5) Total _____
(6) Shield Fern
Present 3
Absent 0
(6) Total _____

(7) FORAGE SUBTOTAL (Add Lines 1-6)

(7) Total _____

(7) Total _____

Snow Conditions (50% of total score)

(8) Elevation (Snowfall 15 pts)
0-500 ft. 15
500-1000 ft 10
1000-1500 ft. 5
1500 ft 0
(8) Total _____

(9) Distance from Coast (5 pts)
< 0.5 mile 5
0.5-3.0 miles 3
> 3.0 miles 1

(9) Total _____

(10) Snow Interception (15 pts)
10+ count 15
8-9 count 13
6-7 count 11
4-5 count 8
2-3 count 4
0-1 count 0

(10) Total _____

(11) Snow Melt (10 pts)
(a) Degrees
< 15 1
2
> 15 2
2
(b) Aspect
South 5
West 3
East
North 0
Flat

(11) Total
_____X_____=_____
Slope X Aspect (10 pts)

(12) Shading (Angle to Horizons 5 pts)
> 30 degrees 0
15-30 degrees 3
< 15 degrees. 5

(12) Total _____

(13) SNOW SUBTOTAL (Add Lines 8-12)

(14) Add Lines 7 and 13
TOTAL (out of 100 possible) _____

Plant Association Code:

Data Entered: Excel ___ GIS ___ FAUNA ___

SHERMAN LIVE TRAPPING OBS _____ DAY (1-3) _____ VISIT (morn/aft) _____ START TIME _____ END TIME _____
MON POINT # _____ DATE _____(m/d/y) START TEMP(C)_____ END TEMP(C) _____ % CLOUDS _____ PRECIP? _____

REQUIRED: trap #, **species** = scientific name, **age**: 1 = adult, 2 = subadult, 3 = juvenile, **sex**: 1 = female, 2 = male, 3 = unk,
breed: 1 = non-breeding, 2 = pregnant, 3 = lactating, 4 = testes enlarged, 5 = unk, **recap** = is it a recapture?, **mark =** did you mark it?
OPTIONAL: weight to nearest 0.1 gram, record for new captures and uncertain IDs, **length** to nearest mm, record for distinguishing features of tricky sp, etc.

Trap number check: **101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210**
301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410,
501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610,
701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810

INCIDENTAL SIGHTINGS (latin name) _____

TRAP #	SPECIES (latin name)	TAXA	AGE	SEX	BREED	RECAP	MARK ?	Total Weight	Bag Weight	Head/ Body Length	Tail Length	Total Length	Hind Foot	Ear Length	COMMENTS

OTHER INFORMATION (Use "N" if Not recorded)

Ranger District _____
ANM CRD HRD JRD KMRD PRD SRD TBRD WRD YRD

Reason for Survey _____ (K) Known Nest (T) New Nest Search (O) Observation (H) Potential Habitat (C) Convenience (R) Random

Travel Used to Conduct Transect _____
(F) Foot (A) Auto (P) Plane (H) Helicopter (K) Kayak (S) Skiff (T) Ranger Boat

Precipitation _____ **(**L) Light Rain (R) Rain (H) Hail (S) Snow (D) Dry

Wind _____ (C) Calm (L) Light M) Moderate (H) High (V) Variable

Cloud Cover _____ © Clear (P) Partly (L) Light (M) Moderate (O) Dark (F) Fog

MIS & OTHER WILDLIFE SURVEY RESULTS

DEER : Total # Pellets: _____ **High Use Areas Mapped** (yes/no) _____

Type of Deer Sign (track, trail, bed) _____

Average Browse Low Medium High **Quick Cruise Plot** (yes/no) _____

BEAR: Total # Sign: _____ **High Use Areas Mapped** (yes/no) _____

Type of Bear Sign (scat, rub, dig, bed, forging area) _____

Average Use Low Medium High

Check if Observed/Heard Bald Eagle ___ Black Bear ___ Brown Bear ___

Brown Creeper _____ Canada Goose _____ Hairy Woodpecker _____

Marten _____ Mountain Goat _____ Murrelet _____ Red Squirrel _____

Red -breasted Sapsucker _____ Red-tail _____ River Otter _____

Sharp shinned _____ Sitka BT Deer _____ Swan _____ Wolf _____

Other Species Observed/Heard:

Data Entry: Excel Goshawk _____ Excel Wildlife Observation _____ FAUNA_____

GIS Entry: Survey Points___ Survey Route___ High Bear/Dear Use ___ Goshawk Habitat___ Wildlife Obs___

Nest Data Entry: Excel Nest Summary _____ GIS nests _____

GOSHAWK & WILDLIFE SURVEY FORM

Project Area/Nest Name : _____ Date: _____

Survey Name _____ Trail/Road/Unit #: _____
(VCU, Year, Month, Day, Survey #, Survey Point Range 12002005070201(1-9))

GOSHAWK SURVEY (Be sure to Include a Map!)

VCU _____ **Year** _____ **Month** _____ **Day** _____

Survey # _____ **# Points** _____ **Survey Type** (BC, NS, VW) _____
(BC) Broadcast Call (NS) Nest Search (VW) Valley Watch)

Surveyors: _____

Surveyor Qualification: Experienced Limited None

Total Time: Start ____: ____End ____: _____ **Total Minutes** _____

 # Broadcast Call Stations: _____ **Type:** Alarm ___ Wail ___ Both ___

Total Number of Valley/Watch Stations: _____

GOSHAWK SURVEY RESULTS **Observation** (Yes/No): _____

Quality Habitat Obs (Yes/No): _____

Method of Obs: Visual ____ Visual/Aural ____ Aural ____ Unknown ____

Time Obs: ____: ____ **# Detected:** _____ **Survey Point #** ____

Reproductive Status: Failed Non-reproducing Reproducing NA Unknown

Group Type: Family Pair Group Single Unknown

Number/Gender (male, female, unknown) of Goshawk Observed:

Adult _____ Juvenile _____ Fledgling ____ Nestling ___ Egg ___ Unknown ___

Activity of Goshawk: _____
(flight, perch, in nest, incubate, brood, beg, roost, territorial behavior, forage)

Nest Location: Documented ____ New _____

Nest/Obs GPS Pt Name: _____ **Pt Type:** WGS84 ___ List Other _____

Lat _____ Long _____

Updated JT 12/8/2005

Broadcast Call & Watch Station Information

Point No.	GPS PT or Local ID	Unit No./ Nest Area	VCU	Start Time	End Time	Goshawk Obs (Yes/No)

Comments For Observations list: age, sex and activity Describe habitat quality